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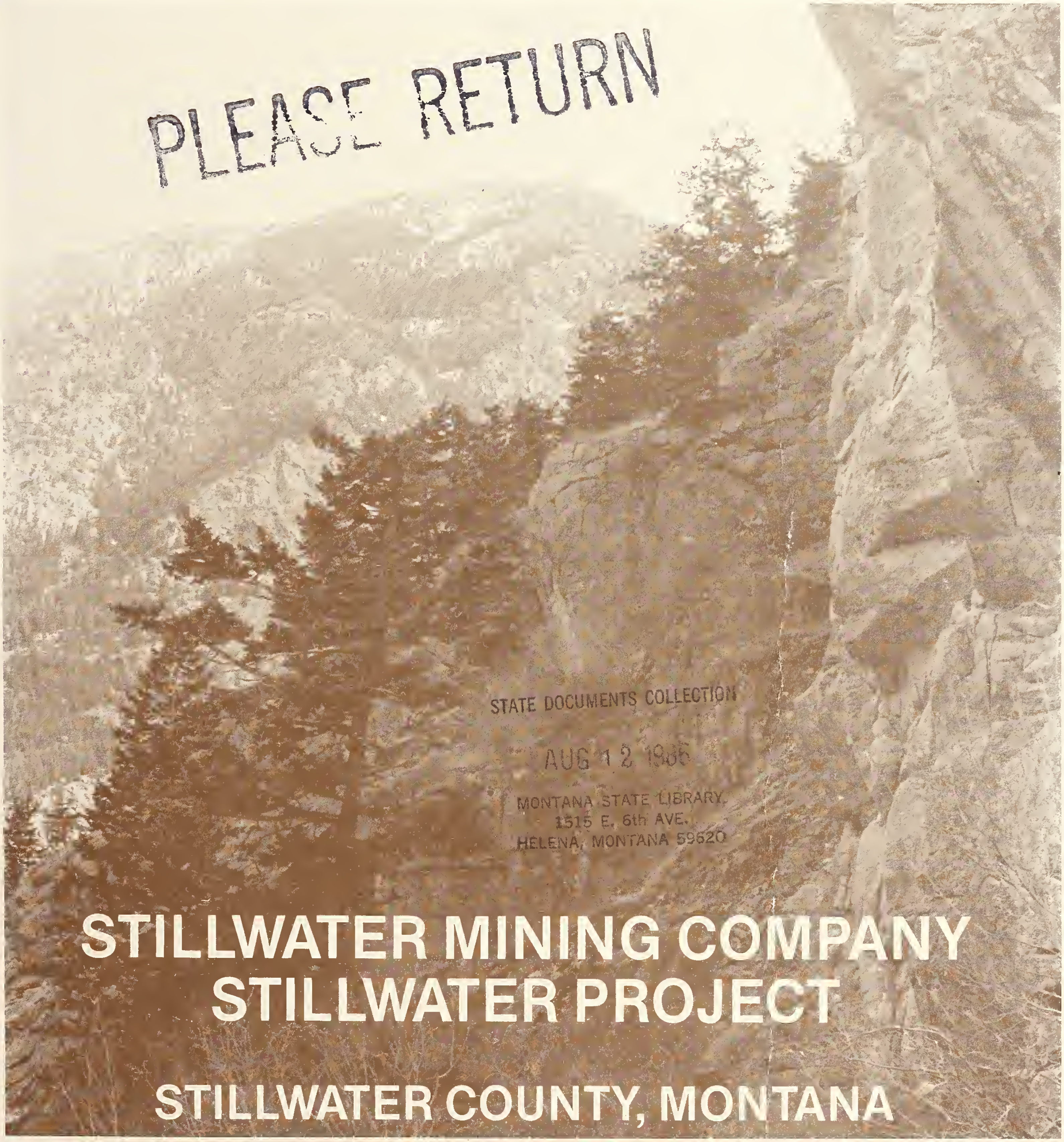

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STILLWATER MINING COMPANY STILLWATER PROJECT

STILLWATER COUNTY, MONTANA

Montana Department of State Lands
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Lead Agencies:

State of Montana, Department of State Lands
U.S. Department of Agriculture, Forest Service

Proposed Action:

Approval of 1,000-ton-per-day platinum-palladium mining and milling project in the Stillwater Valley of southeastern Montana, proposed by Stillwater Mining Company.

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Final

Environmental Impact Statement

STILLWATER PROJECT

STILLWATER COUNTY, MONTANA

December 1985

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Montana Department of State Lands

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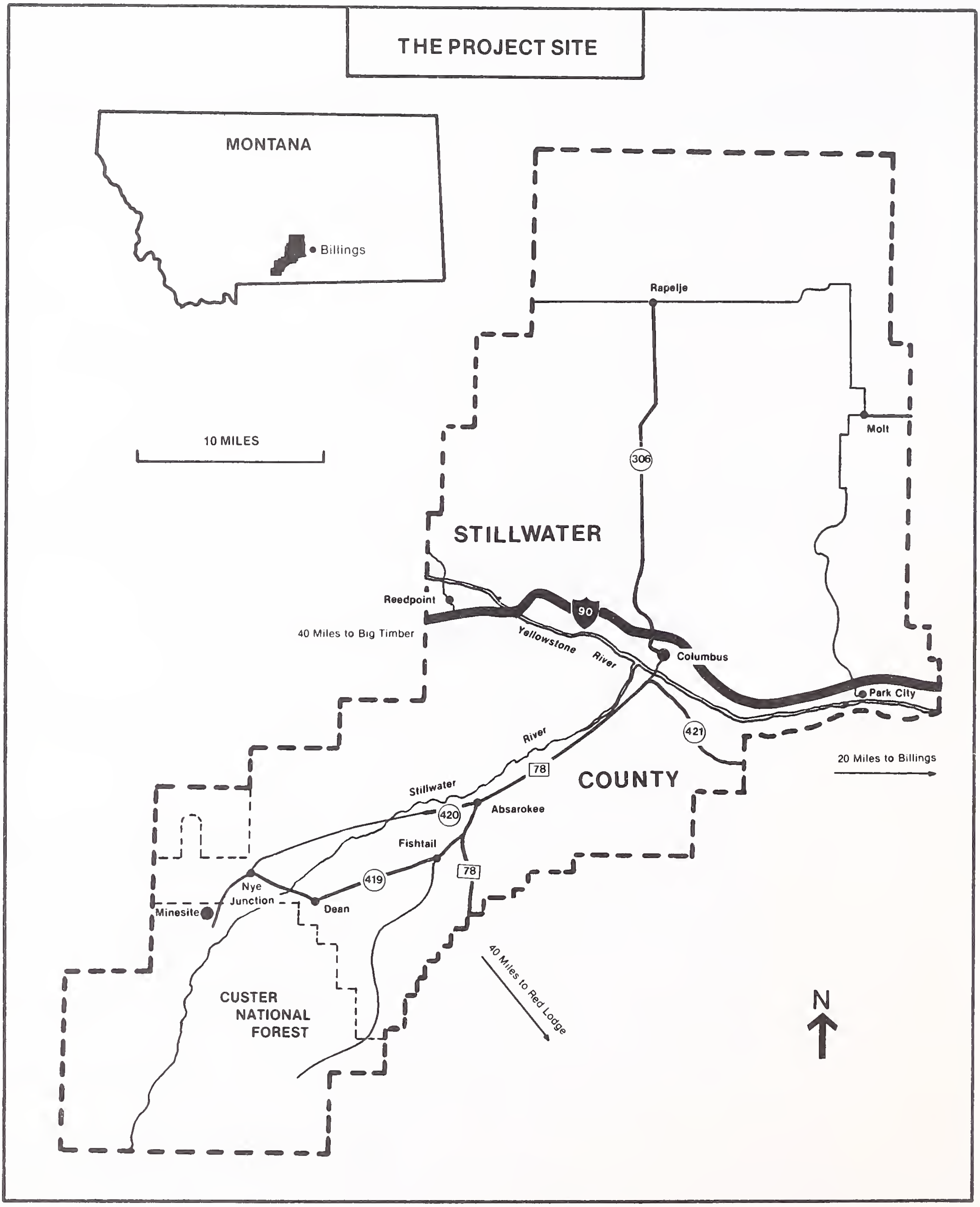

FIGURE S-1

The project site lies six miles south of Nye, in the southern part of Stillwater County. Just south of the minesite is the Absaroka-Beartooth Wilderness. Just east is the Stillwater River and the highway (FAS 419) that would serve the mine.

PREFACE

The Montana Department of State Lands (DSL) and the U.S. Forest Service published a draft environmental impact statement (EIS) in April 1985 on Stillwater Mining Company's (SMC's) proposal to operate a platinum-palladium mine and mill near Nye, Montana.

When the draft EIS was prepared, SMC was proposing shrinkage stoping to mine the narrow platinum-palladium ore zone. All of the waste material (tailings) from the mill would have been sent for disposal to an impoundment constructed at the mine and mill site. At the end of mining, a total of 8.2 million tons of tailings would have been deposited behind the impoundment dam. The dam would have been 160 feet high and covered 79 acres.

The draft EIS analyzed the proposed shrinkage stoping and an alternate mining method--cut-and-fill stoping. Cut-and-fill stoping involves backfilling the stopes with the coarse fraction of mill tailings. The analysis indicated that several environmental benefits would result from cut-and-fill stoping (when compared with shrinkage stoping). These benefits include essentially eliminating the risk of ground subsidence and reducing by about one half the volume of tailings requiring surface disposal. However, the agencies concluded that cut-and-fill mining in reducing ground subsidence would reduce only a minimal hazard to public safety. In addition, the reduced tailings volume size would not noticeably reduce the impoundment size nor have significant environmental benefit. Overall, the substantial added cost of backfilling did not justify the minor environmental benefits.

After publication of the draft EIS, additional underground exploration and mine-feasibility studies were completed by SMC. These studies concluded that only small areas of the ore body can be economically mined by shrinkage stoping. For most of the mine, SMC has determined that cut-and-fill stoping is necessary to control wall rock failure and dilution of the ore.

Due to these new circumstances, SMC amended its application for an operating permit on July 25, 1985. The amended application specifies that mining methods would be cut-and-fill stoping primarily. SMC also revised the design of the tailings impoundment. Because the coarse fraction of tailings from the mill would be placed underground in the mine stopes under this revision, the impoundment capacity, size, and dam height were changed to accommodate a smaller quantity of fine-fraction tailings. The revised impoundment would have a design capacity for 3.6 million tons of tailings and a maximum height of 125 feet, covering about 70 acres, SMC would pump 4.6 million tons of coarse-fraction tailings back into the mine.

SMC's revised application includes other changes, as well. These changes, like the changes in mining method and tailings impoundment design, were analyzed in the draft EIS. In the revised application, SMC proposes to:

--construct a finger-drain system above the pond liner,
--backfill any stopes that are not mined by cut-and-fill methods with tailings should post-mining support be needed to prevent subsidence, and
--fence the storage area for explosives.

In view of this new information, the agencies have made changes in the final EIS. Because shrinkage stoping is not feasible, the production systems that use this mining method exclusively have been deleted in the final EIS. The "backfill" production systems with the tailings disposal facility located at the minesite, Stratton Ranch, or Hertzler Valley are analyzed in the final EIS. The no-action alternative is also analyzed in comparison with the preferred project alternative.

SMC's revised mining method also necessitates changes in the criteria used in the draft EIS to select the preferred production system. The "reclamation" criterion has been deleted because SMC has proposed a finger-drain system for the impoundment. The "expansion potential" and "public safety" criteria are also deleted. SMC's proposed cut-and-fill stoping would substantially increase the expansion potential of the tailings pond. Also, cut-and-fill mining and SMC's commitment to backfill stopes containing incompetent rock would help mitigate the effects of surface subsidence.

STILLWATER PROJECT

Action Under Consideration

Stillwater Mining Company proposes to open a platinum and palladium mine and mill in the Stillwater Valley of Stillwater County, Montana (fig. S-1). The project lies on both private and national forest system lands. The Commissioner of State Lands must decide whether to approve the permit as applied for by Stillwater Mining Company, deny the permit, approve the permit with modified mining or reclamation plans, or approve the permit subject to stipulations. The Supervisor of Custer National Forest must decide whether to approve the plan of operations as submitted, approve a revised plan of operations with changes incorporated, or disapprove the plan of operations.

The Company's Proposal

Stillwater Mining Company proposes to mine platinum and palladium from a steeply dipping mineralized zone lying within the Stillwater mineral complex. The company has begun exploration and, if its permit is approved, could begin developing the mine. The project would last at least 30 years. The company would eventually mine an average of 1,000 tons of ore per day primarily by cut-and-fill stoping, an underground mining method. Other mining methods may be used in portions of the underground workings. Ore would be milled next to the mine. Tailings from the milling process would be deposited in the mine workings and in a tailings pond next to the mill. The project permit area covers 550 acres. Concentrate from the mill would be trucked to Columbus and shipped by rail to various markets.

Areas of Controversy

The main areas of controversy include water quality and quantity, reclamation, wildlife, aesthetic values, transportation, surface subsidence, socioeconomic effects, and scenic quality. (A full discussion of issues is contained in the introduction.)

Preferred Alternative

The agencies' preferred alternative consists of a 4-part package plus mitigating measures. The mitigating measures are listed in Chapter I, Preferred Alternative.

(1) Production System: The agencies have chosen the proposed mining method and tailings impoundment.

(2) Mine Portal Arrangement: The agencies have chosen the proposed arrangement, which calls for 11 mountainside portals.

(3) Access to the West Fork of the Stillwater River Trailhead: The agencies have chosen the company's proposal to use FR 846 for access to the West Fork of the Stillwater River trailhead.

(4) Power Supply: The preferred power supply alternative cannot be chosen until Montana Power Company submits an application for a Certificate of Need and Environmental Compatibility to the Montana Department of Natural Resources and Conservation.

Impacts of the Proposal and Preferred Alternative

Geology: A landslide of the material above the Stillwater Mining Company's minesite, although considered of low probability, would significantly affect the area. Possible collapse of portions of the mine workings would present minimal long-term risk to the public. The tailings dam and proximity to the Stillwater River presents the greatest concern for damage. Potential for dam failure would be low because it would be constructed to exceed minimum dam safety criteria. Impacts of the preferred alternative would be the same as for the proposal.

Hydrology: Mine development would have no greater impact on surface or ground water quality than has exploratory development. The mine would probably discharge about the same amount and quality of water as during exploration. Detectable, but insignificant, increases in nitrate and total nitrogen concentrations in alluvial ground water would continue downstream of the mine. Water quality of the Stillwater River would be unaffected.

Very high flood flows (greater than 1,000-year flood) could encroach on the tailings impoundment, contributing sediment to the Stillwater River. During such a flood, however, the sediment load would be so high from natural sources that the added mine-related sediment would be undetectable. Impacts of the preferred alternative would be the same as the proposal.

Soils: Impacts of the proposal on soils would mainly result from the loss of soil organic matter and a reduction or loss of important soil microorganisms. Because of the loss of organic matter, postmining water- and nutrient-holding capacity would be low. This decreased capacity would probably result in lower vegetative densities during the initial reclamation years. A loss of, or reduction in, soil microorganism populations caused by prolonged soil storage could result in lower plant species diversity and vigor for several years following initial revegetation.

Under the preferred alternative, postmining water- and nutrient-holding capacity of the soil would be higher than under the proposal, and initial vegetative densities would be greater. The remaining soil impact regarding microorganisms populations would still occur since soils would still be stored for prolonged periods.

Vegetation: Mining would destroy 93 acres of undisturbed forest and grassland vegetation and 59 acres of previously disturbed land. Most revegetation (75 percent) would occur after mine closure. Low nutrient- and water-holding capacity of topsoil may cause some revegetation failures. Seeded grasses would establish an erosion-controlling ground cover in most areas. Livestock forage production would increase, primarily due to revegetation of the 59 acres of previously disturbed lands. Plant diversity, however, would decline. Trees and shrubs would be reestablished, although at densities far below premining levels. Over the long term, tree and shrub densities and plant diversity would increase. Livestock forage production would slowly decline to near premining levels. Under the preferred alternative, revegetation failures would be reduced. All other impacts would be the same as described for the proposal.

Aquatic Ecology: Aquatic habitat and organisms would not be affected by the proposal or the preferred alternative.

Fisheries: Fish populations would not be directly affected by the proposal or the preferred alternative. However, population increases in the Stillwater Valley would lead to increased fishing pressure along the Stillwater and its tributaries, possibly leading to reduced fish populations or more conservative fishing regulations.

Wildlife: Mining would disturb only previously developed lands and other noncritical wildlife habitats. Reclaimed lands would eventually furnish adequate wildlife habitat. Mule deer of the Beartooth range and bighorn sheep would lose a small amount of wintering areas. These two species may also respond to mining activity and noises by withdrawing from areas nearby. The bighorn herd has some characteristics which may make it particularly vulnerable to nearby human activity. The Montana Department of Fish, Wildlife, and Parks (letter to the Montana Department of State Lands, August 5, 1982) believes that a herd reduction is imminent and that herd elimination is possible if mining is permitted. Further research would be required to confirm this position. Road kills of deer would increase due to mine-related traffic. Population increases in Stillwater County, of which only a portion would be caused by the mine, would increase housing construction, hunting and other recreation, and poaching by an unknown amount. The Montana Department of Fish, Wildlife, and Parks may respond to increased demand on the wildlife resources by establishing more conservative hunting regulations.

Under the preferred alternative, the effects of mining on the bighorn herd would be investigated. The potential for disturbance of bighorn by mine employees would be reduced. Road kills of mule deer would also be reduced. All other impacts would be the same as described for the proposal.

Threatened and Endangered Species: No threatened or endangered species would be adversely affected by the project or the preferred alternative.

Climate: The small amount of particulate emitted from ground level sources during mining and milling by the proposal or the preferred alternative would not affect the climate of the area.

Air Quality: Particulate matter would be the only pollutant emitted in significant quantities by activities associated with the proposed project. Even so, particulate emissions would be minor. Modeling results indicate that the annual average TSP (total suspended particulate) concentrations would increase by a maximum of 3 $\mu g/m^3$ (micrograms per cubic meter) and 24-hour TSP concentrations would increase by a maximum of 16 $\mu g/m^3$. Wind erosion of disturbed areas during construction activities would also be a potential, but temporary, source of particulate. Impacts of the preferred alternative would be similar to the proposal.

Employment and Income: The proposal and the preferred alternative would have the same impacts on employment and income. The first year of project construction would add 100 to 150 new jobs to total county employment. If the company decides to proceed with project development, the mill would be constructed during the second year, and would provide another 150 jobs (300 total at peak activity). During initial operations, the company would employ 200 full-time workers and in 1991 the number of employees would rise to 220. About 89 jobs are expected to be filled by local residents. The annual wage rate paid at the mine would range from $14,500 for lesser-skilled jobs to $50,000 for senior project management positions.

Sociology: The proposal and the preferred alternative would have the same impacts on the sociology of the area. Either would increase the population of Absarokee and Nye by as much as 25 percent. In turn, the number of mining jobs held by Absarokee residents would make up a large proportion of all jobs. Some current Absarokee residents would have less influence over community matters.

Population increases stemming from mine development would add 510 people to Stillwater County. These increases would amount to 8.1 percent of the population projected for Stillwater County in 1990 without the Stillwater Project, and 7.8 percent in 1995. The population of Absarokee is projected to increase by 220 persons by 1995. This increase would amount to 24.7 percent rise above the 1995 level without the mine. The population of Columbus is projected to increase by 190 persons, a rise of 10.3 percent above the 1995 level without the mine.

Community Services: Projected impacts to community services are based on the assumption that in-migrants will locate as described in Employment and Income. Stillwater County would need additional staff, as would the Sheriff's Department and Department of Social Services. Expansion of the Absarokee sewer system, additional solid waste containers, expansion of the Columbus water system and sewer system, and an additional officer in the Columbus Police Department would also be needed to accommodate increased population. Most area schools would need additional teaching staff and classrooms. The preferred alternative would have the same impacts on the community services as the proposal.

Fiscal Conditions: Either the proposal or the preferred alternative would increase the taxable valuation of property in Stillwater County by $3.7 million. The assessed value would indirectly rise another $343,000, owing to the construction of residential and commercial property. The proposal would also produce $419,441 annually in metalliferous mines license tax revenues and $116,063 in resource indemnity trust tax revenues at full production, assuming current metal prices.

Land Use: The direct land use impacts of the project would be temporary and would not significantly affect land use patterns in the area. About 152 acres would be disturbed by the mine, mill, and tailings pond and as many as 41 acres of other lands could be permanently converted to residential uses. The proposed postmining land uses of wildlife habitat and recreation would be feasible; the reclaimed range condition would be better than it is now; however, the range condition would gradually decline to premining levels. Wildlife habitat reclamation would be generally successful. The preferred alternative would have the same land use impacts as the proposal.

Transportation: The proposal would increase traffic volumes on FAS 419, FAS 420, and FAP 78 because of increases in work, household, and truck trips. FAS 419 and FAS 420 would be most affected by work traffic, FAP 78 by household trips. Increased traffic would result in increased vehicle accidents and road maintenance costs. Ranchers, recreation travelers, and wildlife could be adversely affected by the increased traffic.

The preferred alternative would reduce the total level of mine traffic by 66 percent. Road maintenance and reconstruction costs, and the number of mine-related traffic accidents and fatalities would be less than the proposal. Inconvenience to other motorists and traffic congestion would be lower than impacts of the proposal.

Recreation: The proposal would bring increased use to both the national forest and the private lands along the Stillwater River. This use could increase person-to-person contacts, put additional public pressure on the Forest Service to gain new public access routes to the Custer National Forest, increase harvest of fuel wood, and cause weekend crowding at campgrounds. Visual changes and noise from the mill would affect the recreational quality along FAS 419 and FR 846. In addition, traffic from shift changes would cause increased traffic hazards, particularly on Friday and Sunday afternoons, when recreation travel is heaviest. Impacts of the preferred alternative would be the same as the proposal.

Cultural Resources: No cultural resource sites would be adversely affected directly by the proposal. Thirteen cultural sites, potentially eligible for the National Register of Historic Places, could be indirectly damaged by increased vandalism or relic collecting. Impacts of the preferred alternative would be similar to the proposal.

Aesthetics: Impacts of the proposal and the preferred alternative would be the same. The mine and mill would alter the landscape, significantly affecting the visual resources at the minesite. The visual quality objectives based on mapping done by CDM (1980) would not be met, if at all, until some time after the completion of reclamation. The mine would be highly visible to travelers on FAS 419 and FR 846.

Noise levels near the milling complex would increase considerably. However, since the levels decrease rapidly with distance, travelers on FAS 419 would be exposed to only a small increase in noise levels. Residents within 1/2 mile of the mine could hear noises associated with the facility. Noise levels would be higher on FR 846 through the mine-mill complex. Impacts of the preferred alternative would be similar to the proposal.

Yellowstone Area

The rugged topography of the Beartooth face creates a natural physical barrier for wildlife and people between the project and Yellowstone National Park. The environmental and socioeconomic effects of SMC's project would be localized and limited to the Stillwater Valley. As such, the project would not significantly affect the resources of Yellowstone National Park nor adjacent areas.

Impacts of the Preferred Mine Portal Arrangement

The 11 surface openings would result in decreased vegetative density during initial reclamation due to lowered water- and nutrient-holding capacity of disturbed soils. The new roads built to service adits could cause erosion and would be visible from the valley floor. The small amount of additional bighorn sheep winter range (1 to 2 acres) removed by this alternative would be insignificant.

Impacts of the Proposed and Preferred Road Access Alternative

Use of FR 846 to reach the trailhead in the West Fork of the Stillwater River would cause inconveniences and delays for the public traveling through the minesite.

Impacts of the Power Supply Alternatives

A preferred power supply alternative cannot be chosen until the Montana Power Company submit an application to DNRC to construct a 161-kV power line.

Power Corridor Alternative 1: Alternative 1 could cause slight increases in soil erosion due to construction of temporary roads and in sedimentation levels in streams due to channel crossings. Minor wildlife impacts would include loss of 3 acres of white-tail deer habitat, loss of a small portion of waterfowl wetland habitat, and increased waterfowl deaths due to collision with the power line. Alternative 1 would also route the power line past a historic peregrine falcon nesting site. Potential exists for weed infestation along the corridor. Eleven cultural sites lie within the study area; possible impacts cannot be determined until MPC identifies specific centerlines. The power line would add approximately $3 million to the property tax base of Stillwater County.

Power-line Corridor Alternative 2: Alternative 2 would have minor impacts to increased levels of sediment in streams and to increased soil erosion. The alternative would cause a negligible decrease in white-tail deer habitat and wetland habitat. Some electrocution of waterfowl could occur due to collision with the power line. Weed infestation could occur along the power-line route. Possible impacts to 10 cultural resource sites cannot be determined until specific centerlines are identified by MPC. The Stillwater County tax base would increase about $3 million due to construction of the power line.

On-site Power Generation Alternative 3: On-site power generation would cause minor impacts to air quality, even with the addition of air pollution control devices. Noise levels would be increased 80 dB(A) within the immediate vicinity of the generator and would decrease to insignificant levels at a distance of 640 feet. The stack of the generator would be visible, but such visibility would contribute little to the overall visual impact of the project. On-site power generation would disturb an additional 2 acres within the permit area.

Introduction

The EIS.. IN-1
Scope of the Analysis.................................... IN-3
Previous Research.. IN-5
Agency Responsibilities.................................. IN-6
    Montana Department of State Lands (DSL).................. IN-6
    U.S. Forest Service...................................... IN-6
    U.S. Fish and Wildlife Service........................... IN-7
    State Historic Preservation Office....................... IN-7
    Montana Department of Health and Environmental Sciences... IN-8
        Air Quality Bureau................................... IN-8
        Water Quality Bureau................................. IN-8
    Montana Department of Natural Resources and Conservation.. IN-8
    Hard Rock Mining Impact Board............................ IN-9
    Stillwater County.. IN-9
    Army Corps of Engineers.................................. IN-10
    Local Conservation District.............................. IN-10
Administrative Process................................... IN-10
    Department of State Lands................................ IN-10
    U.S. Forest Service...................................... IN-11

Chapter I Comparing Alternatives, Selecting the Preferred Alternative

Production Alternatives.................................. I-1
    Production Systems....................................... I-1
        The Choices.. I-1
        The Preferred Production System Alternatives......... I-3
    Mine Portals... I-5
        The Choices.. I-5
        The Preferred Mine Portal............................ I-5
    Power Supply Options..................................... I-7
        The Choices.. I-7
        The Preferred Power Supply Option.................... I-7
    Road Access to the West Fork Stillwater River............ I-9
        The Choices.. I-9
        The Preferred Road Access............................ I-10
No-Action Alternative.................................... I-12
    Effects on the Physical and Biological Environment........ I-12
    Effects of the Economic and Social Environment........... I-13
The Preferred Alternative................................ I-13

Chapter II Stillwater Project: Proposal and Alternatives

Stillwater Mining Company's Proposal..................... II-1
    Project Development...................................... II-1
    Mining Plan.. II-6
    Milling the Ore.. II-11
    The Tailings Pond.. II-11
    Water Management... II-13
    Utilities.. II-14
    Roads.. II-14

Chapter II (continued)

Mine Employment II-14
Bonding II-15
Reclamation II-15
Monitoring II-16
Production System Alternatives II-18
Production System Alternative 1 .... II-18
Production System Alternative 2 .... II-19
Cost Estimates of Production System Alternatives II-19
Power Supply Alternatives II-20
Power Corridor Alternative 1 .... II-21
Power Corridor Alternative 2 .... II-21
On-site Generation Alternative 3 .... II-21
Mine Portal Alternatives II-21
Mine Portal Alternative 1 .... II-22
Mine Portal Alternative 2 .... II-22
Capital Costs of Mine Portal Alternatives II-22
Alternative Routes to the West Fork of the Stillwater River II-23
Stillwater Mining Company's Proposal II-23
West Fork Road Alternative II-23
No-Action Alternative II-24

Chapter III Description of Affected Environment

Geology III-1
General Geology--Stillwater Complex III-1
Historical Mining in the Stillwater Complex III-3
Chromite III-3
Copper and Nickel III-3
Platinum-group Metals III-3
General Geology of the Minesite (Proposal) III-4
Topography and Geomorphology III-4
Surficial Geology III-4
Bedrock Geology III-6
Structural Geology III-6
Geologic Hazards III-6
Geology of the Stratton Ranch Site (Alternative 1) III-10
Geology of the Hertzler Valley Site (Alternative 2) III-10
Surficial Geology III-10
Bedrock Geology III-11
Geologic Hazards III-11
Hydrology III-11
Surface Water III-11
Stillwater River III-11
Tributaries of the Stillwater River III-14
Minesite (Proposal) III-15
Stratton Ranch Site (Alternative 1) III-16
Hertzler Valley Site (Alternative 2) III-16
Ground Water III-17
Minesite (Proposal) III-17
Stratton Ranch (Alternative 1) III-23
Hertzler Valley Site (Alternative 2) III-23

Chapter III (continued)

- Soils.. III-25
    - Overview.. III-25
    - Soils of the Proposed Permit Area..................... III-26
    - Stratton Site Soils (Alternative 1).................. III-26
    - Hertzler Site Soils (Alternative 2).................. III-28
    - Prime Farmlands....................................... III-28
- Vegetation... III-28
    - Vegetation Type Descriptions.......................... III-28
    - National Forest Timber Resources...................... III-35
    - Noxious Weeds... III-35
- Aquatic Ecology.. III-35
    - Aquatic Invertebrates................................. III-37
    - Periphyton.. III-37
- Fisheries.. III-38
    - Stillwater River...................................... III-38
    - West Fork of the Stillwater River..................... III-40
- Wildlife... III-40
    - Big Game Species...................................... III-41
        - Mule Deer... III-41
        - White-tailed Deer................................. III-46
        - Bighorn Sheep..................................... III-47
        - Elk... III-52
        - Other Big Game Species............................ III-52
    - Small and Medium-Sized Mammals........................ III-52
    - Raptors (Birds of Prey)............................... III-53
    - Songbirds... III-54
    - Gamebirds and Waterfowl............................... III-54
    - Reptiles and Amphibians............................... III-54
- Threatened and Endangered Species........................ III-54
    - Peregrine Falcon...................................... III-54
    - Bald Eagle.. III-55
- Climate.. III-55
    - Precipitation... III-55
    - Temperature... III-57
    - Winds... III-57
- Air Quality.. III-57
- Employment and Income.................................... III-59
    - Employment.. III-59
    - Income.. III-64
- Sociology.. III-64
    - The Study Area.. III-64
        - Methodology....................................... III-66
        - Demography.. III-66
    - Occupational Structure................................ III-67
    - Values.. III-67
    - Attitudes and Concerns................................ III-68
- Community Services....................................... III-69
    - Schools... III-69
        - Columbus.. III-69
        - Absarokee... III-70
        - Nye and Fishtail.................................. III-70

Chapter III (continued)

- Solid Waste.. III-70
- Law Enforcement...................................... III-70
  - Columbus City Police............................. III-71
- Water Supply... III-71
- Sewer System... III-71
- Fire Protection...................................... III-72
- City Shop.. III-72
- Ambulance.. III-73
- Hospital and Medical Personnel....................... III-73

Fiscal Conditions.. III-73
- Stillwater County.................................... III-73
- Schools.. III-74
- Tax Base... III-74

Land Use... III-74
- Proposed Permit Area and Surroundings................ III-74
- Current and Previous Trends.......................... III-76
- Range Condition and Stocking Rate.................... III-77

Transportation... III-77
- Federal Aid Secondary 419............................ III-77
  - Bridges.. III-78
- Federal Aid Secondary 420............................ III-78
- Federal Aid Primary 78............................... III-79

Recreation... III-79
- National Forest Recreation........................... III-79
- Recreation Outside the National Forest............... III-84
- Community Recreation Resources....................... III-86

Cultural Resources....................................... III-86

Aesthetics... III-87
- Visual Resources..................................... III-87
  - Foothill Subcharacter Type....................... III-87
  - Mountainous Subcharacter Type.................... III-90
- Noise.. III-91

Chapter IV Impacts of the Proposal and Alternatives: Production Systems

Geology.. IV-1
- Impacts All Production Systems Have in Common............ IV-1
  - Removal of Ore....................................... IV-1
  - Geologic Hazards..................................... IV-1
  - Other Mineral Resources.............................. IV-3
  - Blasting... IV-4
  - Mitigating Measures.................................. IV-4
- Impacts Unique to the Proposal........................... IV-4
  - Geomorphology.. IV-5
  - Impoundment Stability................................ IV-5
- Impacts Unique to Alternative 1.......................... IV-6
- Impacts Unique to Alternative 2.......................... IV-7
- No-Action Alternative.................................... IV-7

Hydrology.. IV-7
- Impacts All Production Systems Have in Common............ IV-7
  - Mitigating Measures.................................. IV-8

Chapter IV (continued)

    Impacts Unique to the Proposal.......................... IV-9
    Impacts Unique to Alternative 1.......................... IV-9
    Impacts Unique to Alternative 2.......................... IV-10
    No-Action Alternative.......................... IV-10
  Aquatic Ecology.......................... IV-10
    Impacts Unique to the Proposal and Alternative 1.......... IV-10
    Impacts Unique to Alternative 2.......................... IV-11
    No-Action Alternative.......................... IV-11
  Fisheries.......................... IV-11
    Impacts Unique to the Proposal and Alternative 1.......... IV-11
      Mitigating Measures.......................... IV-11
    Impacts Unique to Alternative 2.......................... IV-11
    No-Action Alternative.......................... IV-12
  Soils.......................... IV-12
    Impacts All Production Systems Have in Common............ IV-12
      Soil Quantity and Quality.......................... IV-12
      Biological Soil Impacts.......................... IV-13
      Unavoidable Soil Impacts.......................... IV-14
    Impacts Unique to the Proposal and Alternative 1.......... IV-15
    Impacts Unique to Alternative 2.......................... IV-16
      Mitigating Measures.......................... IV-16
    No-Action Alternative.......................... IV-16
  Vegetation.......................... IV-17
    Impacts All Production Systems Have in Common............ IV-17
      General Procedures for Revegetation................. IV-17
      Seeding--Herbaceous Species.......................... IV-18
      Woody Species.......................... IV-20
      Noxious Weeds.......................... IV-20
      Mitigating Measures.......................... IV-21
    Impacts Unique to the Proposal.......................... IV-22
    Impacts Unique to Alternative 1.......................... IV-22
    Impacts Unique to Alternative 2.......................... IV-22
    No-Action Alternative.......................... IV-22
  Wildlife.......................... IV-23
    Impacts All Production Systems Have in Common............ IV-23
      Direct Impacts.......................... IV-24
      Indirect Impacts.......................... IV-28
      Mitigating Measures.......................... IV-31
    Impacts Unique to the Proposal.......................... IV-31
    Impacts Unique to Alternative 1.......................... IV-32
    Impacts Unique to Alternative 2.......................... IV-32
    No-Action Alternative.......................... IV-32
  Threatened and Endangered Species.......................... IV-32
    Impacts All Production Systems Have in Common............ IV-32
      Mitigating Measures.......................... IV-33
    Impacts Unique to the Proposal.......................... IV-33
    Impacts Unique to Alternative 1.......................... IV-33
    Impacts Unique to Alternative 2.......................... IV-33
    No-Action Alternative.......................... IV-33

Chapter IV (continued)

Climate.. IV-34
Air Quality.. IV-34
    Impacts All Production Systems Have in Common............. IV-34
    Impacts Unique to the Proposal and Alternatives 1 and 2 .... IV-35
Employment and Income...................................... IV-35
    Employment Impacts All Production Systems Have in Common.. IV-35
    Income Impacts Common to All Production Systems........... IV-36
    Impacts of Extended Mine Life............................. IV-38
    No-Action Alternative..................................... IV-38
Sociology.. IV-39
    Impacts All Alternatives Have in Common................... IV-39
        Demography.. IV-50
        Values.. IV-41
        Housing... IV-41
        Project Concerns...................................... IV-42
        Mine Closure.. IV-43
        No-Action Alternative................................. IV-43
Community Services... IV-44
    Stillwater County... IV-44
        County Administration................................. IV-44
        Law Enforcement....................................... IV-44
        Social Services....................................... IV-45
        Other Services.. IV-45
        Solid Waste Collection................................ IV-45
        Sewer System.. IV-45
        Absarokee Water Users Association..................... IV-45
    Town of Columbus.. IV-46
        Law Enforcement....................................... IV-46
        Street Maintenance.................................... IV-46
        Water and Sewer System................................ IV-46
        Schools... IV-46
    The Effects of Mine Closure............................... IV-47
    Hard-Rock Mine Impact Payment............................. IV-48
    Hard-Rock Mining Impact Trust Account Payments............ IV-49
    No-Action Alternative..................................... IV-49
Fiscal Conditions.. IV-49
    Impacts All Production Systems Have in Common............. IV-49
        Property Tax Base..................................... IV-49
        Metalliferous Mines License Tax....................... IV-50
        Resource Indemnity Trust Tax.......................... IV-51
        Mine Closure.. IV-51
        No-Action Alternative................................. IV-52
Land Use... IV-52
    Impacts All Production Systems Have in Common............. IV-52
    Impacts Unique to the Proposal............................ IV-52
    Impacts Unique to Alternative 1........................... IV-52
    Impacts Unique to Alternative 2........................... IV-52
    No-Action Alternative..................................... IV-53

Chapter IV (continued)

Transportation.. IV-65
  Impacts All Production Systems Have in Common.............. IV-53
    FAS 419.. IV-53
    FAS 420.. IV-55
    FAP 78.. IV-55
    Bridges.. IV-56
    U.S. Forest Service Road 846.............................. IV-56
  Impacts Unique to the Proposal................................ IV-56
    Mitigating Measures... IV-56
  Impacts Unique to Alternatives 1 and 2.................... IV-57
  No-Action Alternative... IV-57
Recreation... IV-57
  Impacts All Production Systems Have in Common.............. IV-57
    National Forest and Wilderness Recreation Resources.. IV-57
    Recreation Resources Outside Custer National Forest.. IV-58
  No-Action Alternative... IV-58
Cultural Resources.. IV-59
  Impacts All Production Systems Have in Common.............. IV-59
  No-Action Alternative... IV-60
Aesthetics.. IV-60
  Impacts All Production Systems Have in Common.............. IV-60
    Landscape.. IV-60
    Noise.. IV-60
    Mitigating Measures... IV-60
      Noise.. IV-62
  Impacts Unique to the Proposal................................ IV-62
  Impacts Unique to Alternative 1................................ IV-62
  Impacts Unique to Alternative 2................................ IV-62
  No-Action Alternative... IV-64
Irreversible and Irretrievable Commitments of Resources
  Short-term Uses Versus Long-term Productivity of the
  Land Affected by Mining.. IV-64

Chapter V Impacts of the Proposal and Alternatives:
- Mine Portal Arrangements
- Power Alternatives
- West Fork of the Stillwater Road Accesses

Mine Portal Arrangements.. V-1
  Proposed Portal Arrangement.................................. V-1
    Mitigating Measures... V-2
  Portal Arrangement Alternative 1............................ V-3
  Portal Arrangement Alternative 2............................ V-3
  No-Action Alternative... V-3
Power Alternatives.. V-3
  Power Corridor Alternative 1.................................... V-4
  Power Corridor Alternative 2.................................... V-6
  On-site Generation--Alternative 3............................ V-7
  No-Action Alternative... V-7
West Fork of the Stillwater Road Access.................. V-8
  Proposed Access Route.. V-8
  Picket Pin Road Alternative...................................... V-8
  No-Action Alternative... V-9

Chapter VI Appendixes

Appendix A: Development of Project Alternatives.............. VI-2
Appendix B: Tailings Pond Siting Study........................ VI-4
Appendix C: Flotation Reagents Used in the Tailings Process... VI-12
Appendix D: Dissolved Consitutent Concentrations in Mill Tailings Waters,. VI-16
Appendix E: Crown Pillar Stability............................ VI-18
Appendix F: Visual Resources System........................... VI-20
Appendix G: Common and Scientific Names of Plant Species...... VI-22
Appendix H: Common and Scientific Names of Fish............... VI-24
Appendix I: Common and Scientific Names of Wildlife Species... VI-26
Appendix J: Ore Reserves and Ownership........................ VI-27

Chapter VII

Literature Cited... VII-1

Chapter VIII Consultation and Coordination

Research and Writing....................................... VIII-1
Review... VIII-2
People, Agencies, and Companies Consulted.................. VIII-2
Review of This Statement................................... VIII-3

LIST OF FIGURES

Summary

S-1--Location of the Project Area............................ ii

Introduction

IN-1--Artist's View of Stillwater Valley..................... IN-2

Chapter I

I-1--Production System Alternatives.......................... I-2
I-2--Mine Portal Arrangements................................ I-6
I-3--Power-line Routes....................................... I-8
I-4--Alternative Access to the West Fork of the Stillwater River.. I-11

Chapter II

II-1--Stillwater Project Permit Area......................... II-2
II-2--Proposed Project Pland................................. II-3
II-3--Land Ownership... II-4
II-4--Mineral Ownership of the Stillwater Complex............ II-5
II-5--Underground Workings................................... II-7
II-6--Shrinkage Stope.. II-8
II-7--Facilities and Tailings Dam............................ II-10
II-8--Tailings Impoundment Cross-Section..................... II-12
II-9--Postmining Topography of Tailings Impoundment.......... II-16

Chapter III

III- 1--Geology of the Stillwater Complex..................... III-2
III- 2--Topography of Upper Stillwater Valley.................. III-5
III- 3--Geology of the Minesite................................ III-7
III- 4--Water Monitoring Sites................................. III-19
III- 5--Geology of the Stillwater Valley....................... III-27
III- 6--Wildlife and Vegetation Study Area..................... III-29
III- 7--Vegetation Types....................................... III-30
III- 8--Aquatic Sampling Stations.............................. III-36
III- 9--Percent of Spawning-Size Rainbow Trout Samples Per Section... III-39
III-10--Montana Department of Fish, Wildlife, and Parks Study Area.. III-41
III-11--Habitat Types.. III-43
III-12--Mule and White-tailed Deer Winter Ranges............... III-45
III-13--Elk and Bighorn Sheep Winter Ranges.................... III-49
III-14--Temperature, Precipitation, and Effective Precipitation at Red Lodge, Montana.............................. III-56
III-15--Wind Speeds at the Hertzler Site....................... III-58
III-16--Wind Speeds at the Minesite............................ III-58
III-17--Monthly Mean Total Suspended Particulate Concentrations.. III-61
III-18--Land Uses in the Stillwater Project Area............... III-75
III-19--National Forest Lands and Recreation Sites in Area Surrounding the Project.............................. III-80

Chapter IV

IV-1--Stillwater Project Employment Schedule................... IV-37
IV-2--Stillwater Project Population Projections................ IV-40
IV-3--Photographic Interpretation of the Stillwater Project..... IV-63

Chapter VI

B-1--Tailings Sites Considered.................................. VI-5

LIST OF TABLES

Chapter I

I-1--Comparison of the Production-System Alternatives.......... I-3
I-2--Summary of Impacts from Mine Portals...................... I-7
I-3--Comparison of the Power Supply Alternative................ I-9
I-5--Comparison of the Road Access Alternatives................ I-10

Chapter II

II-1--Surface Area Disturbance................................. II-2
II-2--Present Value of Cost Estimates for Tailings Disposal Alternatives.. II-22
II-3--Comparison of Capital Costs for Surface Disturbance Alternatives.. II-25

Chapter III

III-1--Ammonia, Nitrate, and Phosphorus Concentrations in Ground Water.. III-22
III-2--Vegetation Types in the Stillwater Study Area........... III-31
III-3--Characteristics of Vegetation Types on the Stillwater Study Area... III-32
III-4--Wildlife Habitat Types and Corresponding Vegetation Types in the CDM Wildlife Study Area.................. III-42
III-5--Mule Deer Population Estimates by Helicopter Survey Unit, MDFWP Study Area.................................. III-44
III-6--Post-Hunting Season Counts of the Stillwater Bighorn Population.. III-48
III-7--Home Range Sizes for Four Bighorn Ewes During Winter.... III-51
III-8--Habitat Use by Bighorn During Winter.................... III-51
III-9--Observed and Expected Numbers of Common Small Mammals Trapped in the Stillwater Study Area.................... III-53
III-10--Size of Largest Storm That Can be Expected at the Project Area During Various Lengths of Time............ III-57
III-11--Ambient Air Quality Standards (AAQS).................. III-60
III-12--Employment by Major Industry in Stillwater County...... III-62
III-13--Stillwater County Employment Statistics................ III-63
III-14--Stillwater County Personal Income by Major Source...... III-65
III-15--Stocking Rates for Areas That Would be Disturbed by Alternatives.. III-76
III-16--Developed Campgrounds and Picnic Areas................. III-81
III-17--Developed Trailheads and Constructed Parking Areas..... III-81
III-18--Occupancy Spots on Public Roads--Number and Capacity... III-82
III-19--Campground Use--Average Number of Units Occupied by Month and Year... III-83
III-20--Average Daily Trail Use............................... III-83
III-21--Recreation Demand Trends for the Beartooth Planning Unit... III-85
III-22--Wilderness Visitor Capacity............................ III-85
III-23--Cultural Resource Sites Potentially Eligible for Listing in the National Register of Historic Places.... III-88
III-24--Historic Sites Potentially Eligible for Listing in the National Register of Historic Places.................. III-89

Chapter IV

IV- 1--Soil Resources of the Proposed Disturbance Area......... IV-15
IV- 2--Proposed Seeding Mixtures for Revegetation............. IV-19
IV- 3--Planting Rates and Estimated Mortality Rates of Trees and Shrubs Planted During Revegetation................. IV-21
IV- 4--Proposed Revegetation Schedule and Revegetation Species Category, Stillwater Mine............................ IV-23
IV- 5--Wildlife Habitat Types Present in Proposed and Alternative Disturbance Areas.......................... IV-25
IV- 6--Inventory of Emission Sources.......................... IV-34
IV- 7--Population Projections With and Without the Stillwater Project.. IV-39
IV- 8--Expected Distribution of Persons Moving into Stillwater County... IV-40

Chapter IV (continued)

IV- 9--Montana School Accreditation Standards.................. IV-47
IV-10--Annual Production and Gross Value of Minerals........... IV-50
IV-11--Taxable Value of Slurry Lines Under the Proposal and Alternatives 1 and 2.................................... IV-51
IV-12--Acres of Rangeland Disturbed Under Each Alternative and Livestock Production Foregone........................... IV-53
IV-13--Current and Projected Traffic........................... IV-54
IV-14--Major Sources and Estimated Noise Levels................ IV-61

Chapter V

V-1--Average Miles of Land Use/Cover Crossed.................. V-6

Appendix

B-1--Sites Considered.. VI-4
B-2--Summary of Step 2: Final Ratings.......................... VI-8
C-1--Estimated Concentrations of Reagents in the Tailings Pond. VI-13
D-1--Estimated Concentration of dissolved Constituents in Tailings Water.. VI-17

THE EIS: WHY IT IS WRITTEN
WHO TAKES PART
WHAT DECISIONS MUST BE MADE

Stillwater Mining Company is proposing to construct a platinum-palladium mine and mill in the Stillwater River Valley of Stillwater County, Montana (fig. IN-1). The Montana Department of State Lands and U.S. Forest Service have determined that the project "may significantly affect the quality of the human environment." As a result, the two agencies are required to prepare an environmental impact statement (Montana Environmental Policy Act [MEPA], 1971, and National Environmental Policy Act [NEPA], 1969).

The Department of State Lands and the Forest Service issued a draft environmental impact statement (EIS) in June 1982 on a similar project proposed by the Anaconda Minerals Company. Work on that EIS was suspended in 1983, when Anaconda signed a joint venture agreement with Chevron USA and Manville Products Company. The June 1983 agreement established a partnership called Stillwater Mining Company and named Chevron USA as the project operator.

Stillwater Mining Company revised the plan submitted by Anaconda. The changes are significant enough that the 1982 EIS was abandoned and this new document has been written.

THE EIS

The National and Montana Environmental Policy Acts require the Forest Service and Montana Department of State Lands (DSL) to go through the same steps:

(1) Issue a draft EIS.
(2) Encourage and accept public comments on the draft.
(3) Issue a final EIS. In accordance with rules adopted by DSL and Council on Environmental Quality regulations, the final EIS may--
    (a) Modify alternatives, including the proposed action.
    (b) Develop and evaluate alternatives not previously given serious consideration.
    (c) Supplement, improve, or modify the analysis contained in the draft.
    (d) Make factual corrections.
    (e) Explain why comments do not warrant further response.
    (f) Identify the preferred alternative.

The EIS analyzes (1) the company's proposal, (2) the lands, people, and resources the proposal would affect, (3) the consequences (or impacts) of the proposal, and (4) reasonable alternatives.

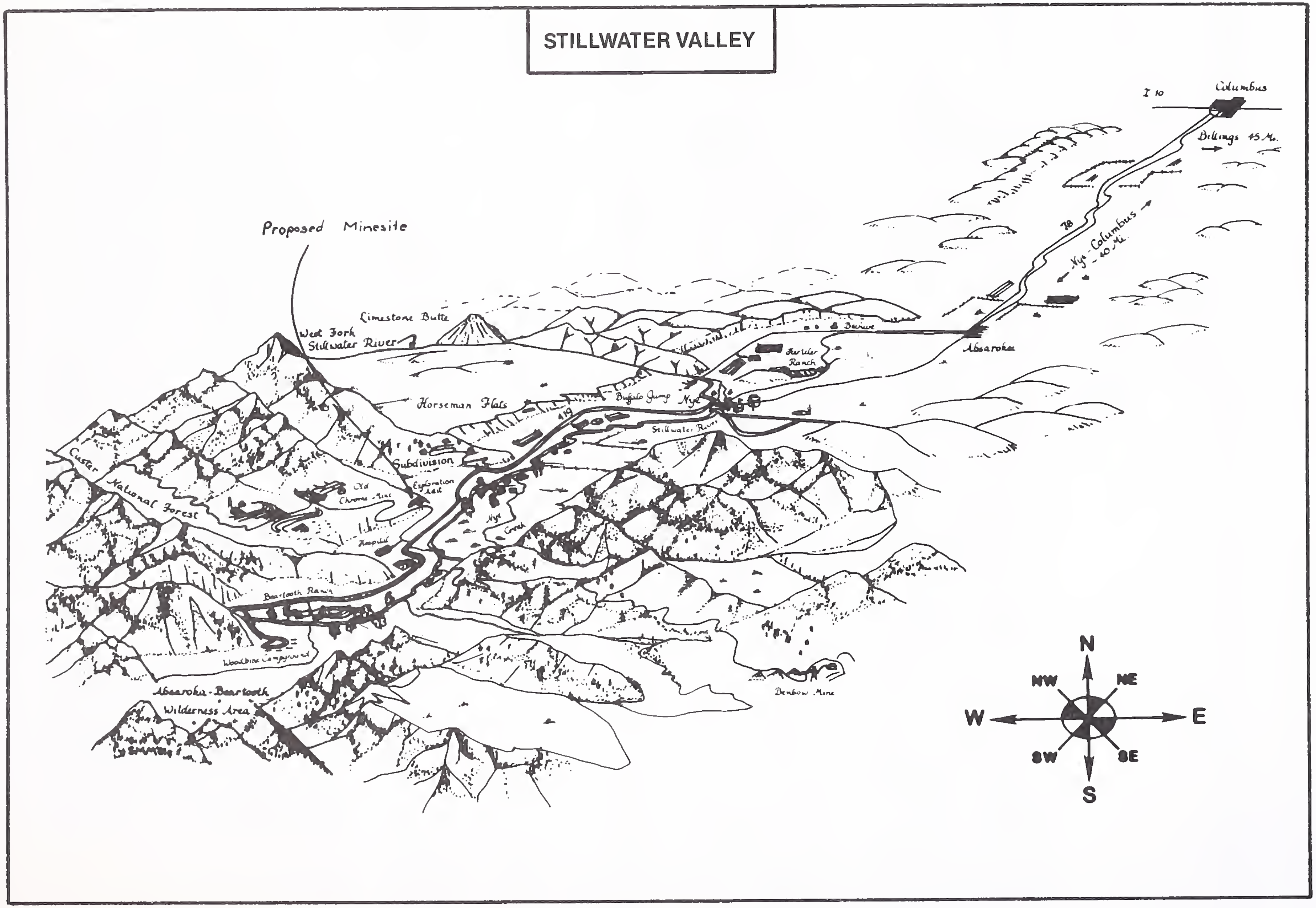

FIGURE IN-1

The mountainous southern part of Stillwater County gives way in the north to rolling hills and plains. Three towns along the Stillwater River--Nye, Absarokee, and Columbus--would be affected by the project.

SCOPE OF THE ANALYSIS

Since starting the analysis on the Stillwater project in 1981, the Department of State Lands and the U.S. Forest Service have formally received comments from the public at four separate times. The concerns expressed in the comments, along with the concerns of the Department and the Forest Service, have formed the scope of the EIS analysis.

The first time the public voiced their concerns over the project was in September 1981 at two "scoping" meetings, which 130 people attended. Comments were received at the same time by mail, in response to a Forest Service mailings of 500 questionnaires. Eighty people returned questionnaires. The Forest Service compiled the results from the meetings and questionnaires and mailed them to the 194 people who had requested them. (The 1981 scoping results are still available from Custer National Forest, Billings and Red Lodge.)

The next time the public spoke out about the project was after the original draft EIS was published in June 1982. The agencies received 32 letters and took testimony at a public meeting from 14 people. (The letters are available for review at the Department of State Lands, Helena.)

The third recent time comments were received was at a meeting following Stillwater Mining Company's filing of a new plan of operations with the Department of State Lands and the Forest Service. In the April 1984 meeting, held in Absarokee, 12 people spoke (about 90 attended). Afterwards, the agencies received letters from eight people. (Meeting transcripts, letters, and scoping results can be reviewed at the Department of State Lands, Helena, or the U.S. Forest Service, Billings or Red Lodge.)

The concerns expressed during this time period guided the preparation of the recent draft EIS issued in April, 1985. A summary of the major concerns follows:

(1) Water Quality and Quantity. Would tailings or mine water contaminate surface or ground water? Would the project affect nearby springs, wells, or the Stillwater River? Would water quality around the project be monitored? How? For how long? What steps would be taken if the monitoring shows the project is polluting surrounding waters? Would the percolation ponds work?

(2) Community Services. Would direct or indirect population growth associated with the project adversely affect area roads, schools, law enforcement, sewer and water systems, solid waste collection, or similar community facilities or services? Would such community development and the need for housing financially burden "existing residents"?

(3) Reclamation. Would the company successfully reclaim the areas disturbed? What would the company do to overcome the problems posed by thin soils and high elevations? Could introduction of weeds during revegetation be avoided? How would reclamation success be judged? How long would the company monitor reclamation? How long would the reclamation bond be held? Would the tailings impoundment be stable and resist erosion?

(4) Fisheries and Aquatic Ecology. Would the project result in decreased sport fishing opportunities, fish populations, and increased fishery management needs? Would the project affect aquatic life? Would aquatic invertebrate populations be monitored?

(5) Recreation. Would the project reduce recreational opportunities, lower the quality of recreational experiences, or conflict with recreation traffic?

(6) Air Quality. Would the project emit air pollutants? How much dust would there be?

(7) Wildlife. Would the project directly or indirectly disrupt wildlife populations, including mule deer, elk, bighorn sheep, and the two endangered species found in the project area--the bald eagle and peregrine falcon? Would measures be taken to prevent roadkills? Would wildlife populations be monitored?

(8) Wilderness. Would population growth affect wilderness recreation?

(9) Life Style. Would the project affect the rural life style in the area?

(10) Land Use. Would the project result in a change in the use of lands from agricultural to residential uses, particularly near existing towns? Would land values appreciate? How would agriculture be affected? Would the company control the spread of noxious weeds?

(11) Aesthetic Values. How would the project affect scenic quality? Would the project buildings be placed to keep scenic deterioration to a minimum? How much noise would the operation make?

(12) Mining Methods. Are there any other ways of mining, such as cut-and-fill stoping, that would reduce mine impacts?

(13) Subsidence. Would the ground above the mine subside? What would the company do to prevent or repair surface holes or depressions?

(14) Alternatives. Has the company explored all alternative transportation and mining methods? What about different tailings pond sites? How do the costs of each alternative compare?

(15) Power. How large a power line would the project require? Where would it be placed? What impacts would it have? What affects would power lines within the permit area have?

(16) Transportation. What would happen to the condition of nearby roads and highways? How much would traffic increase? Would road safety decline? Would the company bus workers to the mine? How would traffic affect ranching operations that use FAS 419? What about impacts on FAS 420? How would residents along these roads be affected?

(17) Income. Would high-wage mine jobs raise the local cost of living, especially the cost of housing?

(18) Employment. What would happen to people moving to the area to find work at the mine who, in fact, cannot get a job? How would the project affect outfitters?

(19) Taxes. Would the mine increase property taxes by raising property values? How would taxes be affected?

(20) Mine Shutdown. What would happen to employment, income, and taxes when the mine closes? What measures would be taken to stabilize the tailings pond? What if the mine shuts down early? What if it closes temporarily?

(21) Milling Chemicals. How toxic are the milling chemicals? Would they leak into the ground water or blow into the air? Would the mill produce hazardous wastes? How would they be handled and disposed of?

(22) Water Use. How much water would the operation need? Would company withdrawals affect other water users?

(23) Natural Hazards. What is the chance of landslides, floods, and earthquakes in the project area? What impact would they have? Could the tailings dam fail?

(24) Cumulative Impacts. What would the impacts be if the mine stayed open much longer than expected? What if more mines opened in the area? How would the project affect the greater Yellowstone ecosystem?

After distribution of the draft EIS, the agencies received a total of 41 letters. In addition, 5 people testified at a public hearing held May 15, 1985, in Absarokee. The letters and hearing testimony are reproduced in Chapter VI along with responses by the agencies. Where appropriate, revisions have been made in the final EIS.

PREVIOUS RESEARCH

The EIS analysis draws data from many sources, each containing the most up-to-date information available. The sources are listed in full under Literature Cited at the end of the EIS. The most important documents are also described here.

Of primary importance to the EIS is Stillwater Mining Company's plan of operations, or application for a mining permit. The plan contains detailed information on the company's entire operation. For those interested, the plan is available for review at the Department of State Lands, Helena, the U.S. Forest Service offices in Billings and Red Lodge, and at Stillwater County's planning offices in Columbus.

Incorporated by reference into the mining plan are the studies performed during 1980 and 1981 by Camp, Dresser, and McKee, a consulting firm that gathered information on the current environment of the project area. The data range broadly, covering such topics as hydrology, soils, vegetation, archaeological sites, wildlife, and fisheries. Much of the information found in the EIS comes from the descriptions and species inventories in the Camp Dresser and McKee studies. For those interested, the studies are available for review at the Department of State Lands, Helena, and the U.S. Forest Service, Billings and Red Lodge.

Additional information on big game comes from studies by the Montana Department of Fish, Wildlife and Parks. The species covered primarily include bighorn sheep, elk, mule deer, and white-tailed deer.

Information that forms the basis of the tailings pond alternatives evaluated in the EIS comes mainly from two siting studies. One, prepared under contract to Anaconda Minerals Company, was performed by Mountain States Mineral Enterprises (MSME). The second, prepared by the Department of State Lands and the Forest Service, was performed to corroborate and expand on the findings of the MSME study. The second study is summarized in appendix A, and both studies are on file and available for review at the offices of the Forest Service and Department of State Lands.

The power-line discussion is based on a preliminary report supplied by the Montana Power Company (MPC). A detailed analysis of the power-line corridors will be prepared by the Montana Department of Natural Resources and Conservation, when MPC submits a complete application for the Certificate of Environmental Compatibility and Public Need.

AGENCY RESPONSIBILITIES

A number of agencies have or could have jurisdiction over the Stillwater Project.

Montana Department of State Lands (DSL)

DSL administers the 1971 Montana Metal Mine Reclamation Act (also called the Hard Rock Mining Act), with which Stillwater Mining Company must comply. The purposes of the act are, first, to recognize and protect the usefulness, productivity and scenic values of the lands and waters within the state, and second, to reclaim to beneficial use the lands used for metal mines. The act and its regulations (ARM 26.4.101 et seq.) set forth the steps that must be taken in the issuance of an operating permit for, and the reclamation of, Stillwater Mining Company's proposed mine and mill. The act applies to all lands within Montana. Thus, the Department of State Lands will regulate mining activity on both federal and private lands.

U.S. Forest Service

The Forest Service has authority for permitting and regulating all operations and uses of national forest system lands. Figure II-3 shows national forest system lands at the project site.

The 1872 General Mining Law, as amended by the Multiple Surface Use Act (P.L. 167) of July 23, 1955, allows any prospector who discovers a valuable mineral deposit on national forest system lands open to mineral entry to locate and work on a mining claim. (See also 36 CFR 228.) At the same time, the Organic Administration Act of 1897 authorizes the Secretary of Agriculture to regulate occupancy and use of the national forests for the protection and management of national forest resources--this pertains to all national forest users, including prospectors and miners. The Forest Service thus retains the right to manage and dispose of surface resources on unpatented mining claims to the extent that this does not unreasonably interfere with mining activity.

(Note that mining claims are either patented or unpatented. Patented claims are lands formerly owned by the government that have become private property. Patented claims are not regulated by the Forest Service. Unpatented claims are lands for which the surface is still owned by the federal government and managed in this case by the Forest Service. Mining on unpatented claims [and on unclaimed lands] is subject to federal regulations. The claimant may patent a claim by demonstrating a discovery of a valuable mineral deposit and by complying with other legal requirements. Once a claim is patented, regulatory authority falls solely to DSL. Stillwater Mining Company's development would occur on both patented and unpatented claims.)

The U.S. Forest Service management policy for mining activity originates from the Mining and Mineral Policy Act of 1970, the National Materials and Minerals Policy, Research, and Development Act of 1980, and a number of executive (presidential) orders.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service administers the Endangered Species Act, as reauthorized in 1982, and the Bald Eagle Protection Act of 1940 (as amended). Federal agencies (in this case, the U.S. Forest Service) involved in actions potentially affecting threatened or endangered species must prepare a biological assessment to comply with the Endangered Species Act. If the assessment determines impacts would adversely affect threatened and endangered species, the preparing agency consults with the Fish and Wildlife Service to design measures to protect the affected species. Biological assessments on bald eagles and peregrine falcons were prepared by the Forest Service in 1982, 1984, and 1985 (U.S. Department of Agriculture, 1982, 1984, and 1985).

State Historic Preservation Office

The State Historic Preservation Office has the responsibility to cooperate with and to advise the Department of State Lands and Forest Service when potentially valuable historical, archaeological, or other cultural resources are located in a project area (Montana Antiquities Act [MCA 22-3-401 through 22-3-442], and the National Historical Preservation Act [P.L. 89-665 as amended and reauthorized E.O. 11593]). Part of the advice given to the Department may include comments on a company's plan for impact mitigation of sites eligible for nomination to the National Register of Historic Places. The office also reviews the EIS to ensure compliance with cultural resource regulations.

The State Historic Preservation Office is responsible for issuing antiquities permits for projects on state-owned lands. The office seeks determinations from the Keeper of the National Register for sites believed to be eligible for listing on the National Register of Historic Places. During mine operation, the Department of State Lands is responsible for monitoring compliance with historic preservation and monitoring plans.

Montana Department of Health and Environmental Sciences

Air Quality Bureau

The Air Quality Bureau of the Department of Health and Environmental Sciences administers the Montana Clean Air Act. Any proposed project which has the potential to emit more than 25 tons per year of any pollutant, must obtain an air quality permit prior to the commencement of construction. The applicant must apply Best Available Control Technology (BACT) to each emission source. The applicant must also demonstrate that the project will not violate Montana or Federal Ambient Air Quality Standards.

Water Quality Bureau

The Water Quality Bureau of the Montana Department of Health and Environmental Sciences is responsible for administration of the Montana Water Quality Act. This state law provides a framework for the classification of surface water. It also establishes surface water quality standards as well as permit program to control the discharge of pollutants into state waters.

A Montana Pollutant Discharge Elimination System permit (MPDES) must be obtained before any discharge to surface water can occur. The MPDES permit contains water quality limitations and requires self-monitoring of effluent by the permittee. A Montana Groundwater Pollution Control System (MGWPCS) permit must be obtained prior to discharging pollutants into state ground waters. This permit also sets effluent limitations and requires ground water quality monitoring.

The company must construct and operate the proposed tailings pond to prevent water discharge, seepage, drainage, infiltration or flow that may pollute surface or ground waters. The company must submit complete plans and specifications of the tailings pond to the Department of Health and Environmental Sciences no less than 180 days prior to initial construction.

Montana Department of Natural Resources and Conservation

The Department of Natural Resources and Conservation administers two acts that are applicable to mining development in Montana: The Montana Major Facility Siting Act (MFSA) and the Montana Water Use Act. The MFSA requires state approval before construction of any electrical transmission line that exceeds 69 kilovolts (kV) or 10 miles in length. A water rights permit is required for any surface water diversion or ground water withdrawal exceeding 100 gallons per minute by the Montana Water Use Act.

Hard Rock Mining Impact Board

The Hard Rock Mining Impact Board (Hard Rock Board) created by the passage of House Bill 718 in 1981 is attached to the Montana Department of Commerce for administrative purposes. It is a quasi-judicial board intended to act as a "referee" in hearing disputes between local government units (for example, Stillwater County, the town of Columbus, and school districts) and large-scale mineral developers over the impact mitigation plan prepared by the developer. In the impact mitigation plan, the developer identifies the increased public sector costs associated with major mineral development and commits to pay, according to a specified time schedule, all increased capital and net operating cost to local government units that will be a result of the development.

The review of the impact plan by affected units of local government is intended to occur concurrently with the procedure for fulfilling the operating permit requirements. If disagreement occurs between Stillwater County or any affected unit of local government and the proponent, the disagreeing party can file an objection with the Hard Rock Board.

An operating permit issued by the Department of State Lands for a large scale mineral development shall be conditioned to provide that mining may not commence until the Hard Rock Board approves the impact plan and until the permittee has provided a written guarantee to DSL and to the Hard Rock Board of compliance within the time schedule with the commitment made in the impact plan approved by the Hard Rock Board. If the permittee does not comply with that commitment within the time scheduled, the State Board of Land Commissioners, upon receipt of written notice from the Hard Rock Board, shall suspend the permit until it receives written notice from the Hard Rock Board that the permittee is in compliance.

Stillwater County

Stillwater County has the option to--

- Adopt zoning regulations pursuant to 76-2-101 through 76-2-112, MCA, (if properly petitioned) that would control the location of the mill and tailings site.
- Review and issue a floodplain development permit for any activity that infringes on the 100-year floodplain.

The county previously adopted a zoning regulation using the petition process that set up a planning and zoning district in southern Stillwater County. The regulation required that a zoning permit be obtained before an ore processing mill site could be located in the district. Although the proposed mill would not be located in an existing planning and zoning district, the county could expand the boundaries of the district to take in the proposed mill site or establish a new district.

Army Corps of Engineers

The Corps of Engineers would require a 404 permit if any bridges are replaced or strengthened in a manner that would put fill in any river. Need for a 404 permit is not anticipated at this time.

Local Conservation District

Similarly, bridge construction plans would require approval by the local conservation district if the company were planning to alter streambanks.

ADMINISTRATIVE PROCESS

After evaluation of this EIS, both the Department of State Lands and the Forest Service have a number of options.

Department of State Lands

The Department of State Lands must take one of four administrative actions: (1) approve the permit as proposed, (2) deny the permit, (3) approve the permit with modified mining or reclamation plans, and (4) approve the permit subject to stipulations.

1. Approve the Permit as Proposed

The Department of State Lands could approve Stillwater Mining Company's application without modifications or special conditions.

2. Deny the Permit

The Department may deny the permit if the mining or reclamation plans violate the laws administered by the Department of State Lands or the water and air quality laws administered by the Department of Health and Environmental Sciences.

3. Approve the Permit with Modified Mining or Reclamation Plans

If the proposed plan were unacceptable, the Department could return it with a request that the company submit a modified plan. If, for example, the Department selected an alternative from chapter IV different from Stillwater Mining Company's proposal, the Department would require the company to submit new project plans.

4. Approve the Permit Subject to Stipulations

If parts of the proposed plan were considered unacceptable, the Department could grant the permit with stipulations. Possible stipulations would include any modifications or additions to the proposed plans that the Commissioner considered necessary to meet the requirements of state laws.

U.S. Forest Service

Four administrative actions, some of which differ from those available to the Department of State Lands, will be considered by the U.S. Forest Service: (1) no action, (2) approve the plan of operations as submitted, (3) approve a revised plan of operations with changes incorporated, and (4) approve parts of the plan that are acceptable; defer decisions on other portions of the plan.

If the plan of operations is approved, the Forest Service would periodically inspect operations to determine if Stillwater Mining Company is complying with the approved plan. If the company fails to comply with the regulations or approved plan of operations and if the noncompliance is unnecessarily or unreasonably causing injury, loss, or damage to surface resources, the Forest Service would notify the company in writing of the noncompliance, specify the action needed, and specify the time period for completing the action (36 CFR 228.7 and 36 CFR 228.9). The plan of operations, essentially a contract between the Forest Service and the Stillwater Mining Company, would be effective as long as mining is conducted or reclamation is required. The period of liability under the Forest Service bond would be consistent with long-term reclamation needs.

1. No Action

Under this action, the proposed plan of operations would be denied and, theoretically, no mining could take place; however, this alternative is not valid because under the general mining law of 1872 the national forest lands on which the project would occur are open to mineral location and entry. Consequently, the Forest Service cannot take "no action" if Stillwater Mining Company meets legal and policy requirements and takes reasonable measures to protect surface resources and public safety. However, because CEQ regulations require analysis of a no-action alternative even if it is outside the jurisdiction of the agency, this alternative is evaluated in order that consequences of abandonment of the project can be compared with project development.

2. Approve the Plan of Operations as Submitted

If the Forest Service agrees that the plan of operations is complete and adequate as submitted and no changes are required, the Forest Service would approve it.

3. Approve a Revised Plan of Operations With Changes Incorporated

If the plan of operations as proposed were deemed generally acceptable but in need of some revisions, the Forest Service could require changes. These changes would be for management and protection of the surface resources of national forest system lands or public safety. Such changes could not be aimed at managing mineral resources because the Forest Service does not have the authority to regulate mining activities that do not affect either the surface resource or public safety.

This administrative action would be selected if the Forest Service chooses to require an alternative different from the company's proposal or to require any of the mitigating measures recommended in the EIS. If the Forest Service does select an alternative different from Stillwater Mining Company's proposal, the company would be required to submit modified mining plans.

4. Approve Parts of the Plan of Operations

The Forest Service could approve part of the plan of operations and defer decisions on other parts of the proposal until further design data or specific information is available. The Forest Service would take action on these aspects of the proposal based on the degree to which they meet the objectives of reasonable environmental protection.

COMPARING ALTERNATIVES AND SELECTING THE PREFERRED ALTERNATIVE

The preferred alternative was concluded from an analysis of:

- A production system, chosen from three alternate tailings disposal locations.
- A mine portal arrangement, chosen from three arrangements.
- An electrical power supply, chosen from three options.
- A public access route to the West Fork of the Stillwater River, chosen from two possibilities.
- The no-action alternative.

PROJECT ALTERNATIVES

Production Systems

The Choices

The proposal by Stillwater Mining Company (SMC) is to locate the mine facilities, including the mill and tailings pond, at the former Mouat Mill site (fig. I-1). SMC would primarily use cut-and-fill stoping although, where practical, ore would be mined using shrinkage stoping. Over half of the mill tailings (the coarse fraction of tailings) would be pumped into the mine. Construction and operation of the project would disturb 152 acres, including 70 acres for the tailings pond and its earthen dam. The tailings pond would be lined with impervious hypalon sheeting. In addition, a finger-drain system would be constructed on top of the liner. At the end of mining, the dam would hold 3.6 million tons of fine-fraction tailings and be 125 feet in height. Waste rock from the mine would be used in construction of the tailings pond dam, roads, and portal yards, or placed back into the mine. A small portion of FAS 419 and Forest Service Road (FR) 846 would be relocated around the tailings dam.

Alternative 1 (fig. I-1) would be similar to Stillwater Mining Company's proposal, with exception that the tailings pond would be located at the Stratton Ranch. A two-mile slurry pipeline would be constructed to transport tailings from the mill to the tailings pond. Also, a waste rock dump and emergency tailings impoundment would be constructed at the minesite. The acreage covered by the tailings impoundment would be 77 acres and the height of the dam would be about 82 feet.

Alternative 2 calls for locating the tailings impoundment at Hertzler Valley (fig. I-1). The pond however would not be lined with hypalon. The dam and pond would cover about 129 acres and reach 85 feet in height. Tailings from the mill would be slurried 7 to 9 miles through a pipeline to the tailings impoundment. An emergency pond and waste rock dump would also have to be constructed at the minesite.

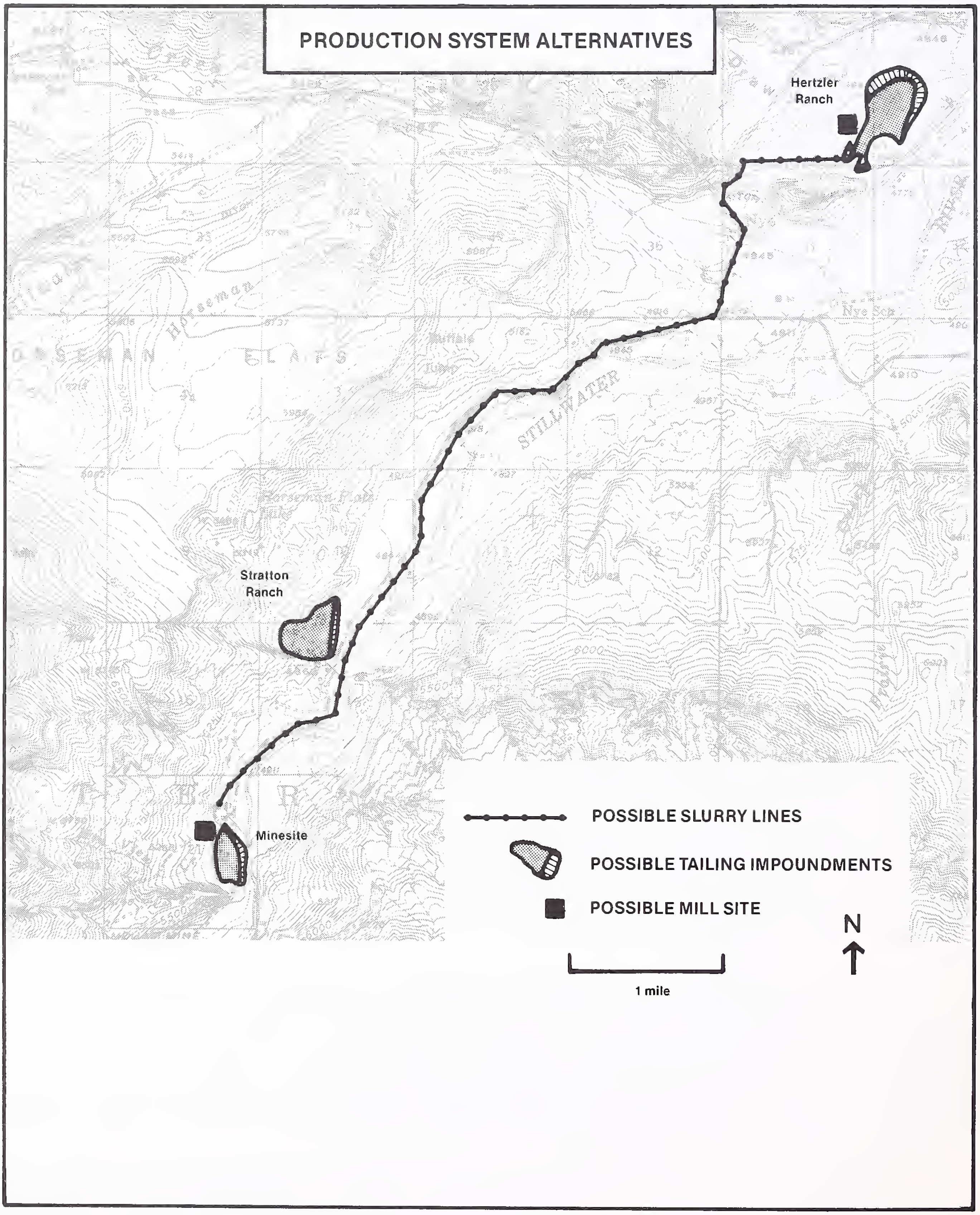

FIGURE I-1

Two alternative production systems have been evaluated in the EIS. The alternatives comprise differing arrangements of tailings transportation methods and tailings impoundment locations.

Impacts of the proposal and alternatives are compared in table I-1.

TABLE I-1

Comparison of the Production-System Alternatives

	Proposal	1	2
Geology	Impoundment failure unlikely	Potential for impoundment failure.	Impoundment failure unlikely.
Hydrology	Minimal change in surface and ground water quality. No affect on present and future beneficial uses.	Potential for increased sediment loads in Stillwater River.	Minimal change in surface and ground water quality. No effect on present or future beneficial uses.
Wildlife	152 acres of mule deer habitat, and 131 acres of bighorn sheep winter range removed.	112 acres of mule deer habitat and 96 acres of bighorn sheep winter range removed.	255 acres of mule deer habitat and 96 acres of bighorn sheep winter range removed.
Threatened & Endangered Species	Dam construction may reduce the suitability of bald eagle feeding habitat.	Dam construction may interfere with bald eagle roosting and nesting.	Reduction in a small percentage of peregrine falcon hunting habitat.
Visual	Major disturbance--highly visible during and after mining. Previously disturbed land.	Major disturbance and highly visible. Low postmining visual impact, but noticeable.	Major disturbance, but not very visible. Low postmining visual impact.

The Preferred Production System

The company's proposal to locate the tailings pond and associated facilities at the minesite is the agencies preferred production system alternative.

The agencies used seven criteria to select the most acceptable production system. The selection criteria address (1) those impacts or potential impacts that differ sharply among the alternatives and the proposal and (2) those impacts that are major public concerns. No selection criteria were developed to address impacts that are common to all alternatives and the proposal.

The selection criteria:

1) Site Suitability. The tailings site should accommodate the tailings impoundment without requiring special design measures to ensure its stability. For example, sites with unstable ground or a high ground water table are undesirable.

2) Impoundment Spill Control. The tailings impoundment location should provide opportunities to control surface and ground water discharges resulting from impoundment breaching or leaking. Sites near the Stillwater River are less favored than those farther away.

3) Slurry Line Rupture. Risk of rupture should be low; the potential for containing spills should be high. Topographic constraints can cause excessive wear on slurry line systems.

4) Cost. The cost of environmental mitigation must be worth the public benefit.

5) Other Wildlife. Long-term, adverse impacts to mule deer herd populations should be minimized. (Since all alternatives and the proposal pose similar impacts to bighorn sheep and elk, selection criteria for these species are not considered in the comparative evaluation.)

6) Threatened and Endangered Wildlife. Adverse impacts on threatened and endangered species must be mitigable as required by the Endangered Species Act.

7) Visual Resource. Visual impacts should be minimized.

Rationale: Although acceptable, alternative 1 was ruled out because of uncertainties about unstable ground at the Stratton Ranch tailings pond site and high ground water conditions. Both conditions would require special drainage measures to prevent slope destabilization and to assure foundation integrity. In addition, the tailings pond would be visible from residences in the Cathedral Mountain Estates Subdivision.

With exception of cost, the proposal and alternative 2 have no substantial differences when judged by the seven selection criteria. Hydrologic and geologic characteristics at both disposal sites are favorable for construction and operation of the respective impoundment designs. Relative to the proposal, the Hertzler Valley offers a greater distance between the tailings pond and the Stillwater River for control of dam failure or seepage. On the other hand, the tailings pond at the minesite eliminates the risk of a tailings pipeline spill. In both cases, however, the risk of spills is low: rockfill dams can withstand substantial movement without failure. Similarly, adequate safeguards can be designed into a pipeline to prevent rupture and control spills.

Alternative 2 would remove the most acres of mule deer habitat, and the proposal would remove the most acres of bighorn sheep winter range. The proposal and alternative 2, however, would remove only marginal bighorn sheep winter range.

During and after mining, the proposal would significantly affect the visual resources at the minesite. Alternative 2 would have less visual impact during and after mining. Although the tailings pond at Hertzler Valley would be a substantial disturbance during the project life. In comparison, the proposal would confine the mining disturbances to mostly previously disturbed land. Fewer acres would be disturbed, and fewer acres would require reclamation after mining.

Construction of the dam at the minesite could possibly reduce the suitability of feeding habitat adjacent to the mine for bald eagles; however, it is unlikely that activity associated with the project would adversely affect bald eagles.

A major difference in the two production systems is cost. Over the life of the project. alternative 2 would increase total capital and operating expenses 3.6 million dollars. However, the net gain in environmental protection brought about by the added cost of alternative 2 is not readily discernible in either the short or the long term.

Mine Portals

The Choices

Eleven portals (mine openings) are proposed to serve the underground workings (fig. I-2). A small service yard would be constructed with waste rock at each portal. Four of the portals would require a new road on the hillside above the main mine facilities.

Two alternatives (fig. I-2) are analyzed in this EIS that would reduce the amount of road construction and mountainside disturbance. In the first alternative, the company would use only the two existing portals: the Minneapolis portal (5,150 level) and the 6,550-level portal. This alternative would eliminate nine portals and associated yards and 1.4 miles of new road. In the second alternative the company would eliminate only three portals: the 5,950-, 6,150-, and 6,350-level portals. The yards and switch-back road associated with these three portals would similarly be eliminated (see table I-2). Note that the Mountain View shaft, associated service road, and associated power line would still be required under both alternatives and the proposal.

The Preferred Mine Portal

The company's proposal of eleven portals is the preferred arrangement of mine openings.

The selection criteria used to choose the preferred alternative include--

1) Minimize Visual Impact. Modifications should reduce the effects on visual resources.

2) Cost. The cost of mitigation should be worth the public benefit.

Compared to alternatives 1 and 2 the proposal would result in the most road construction and mountainside disturbances. However, more portals and roads would not noticeably add to the visual impacts caused by the mine facilities and associated disturbances. Reclamation of the portals and new roads after mining would minimize long-term visual impacts.

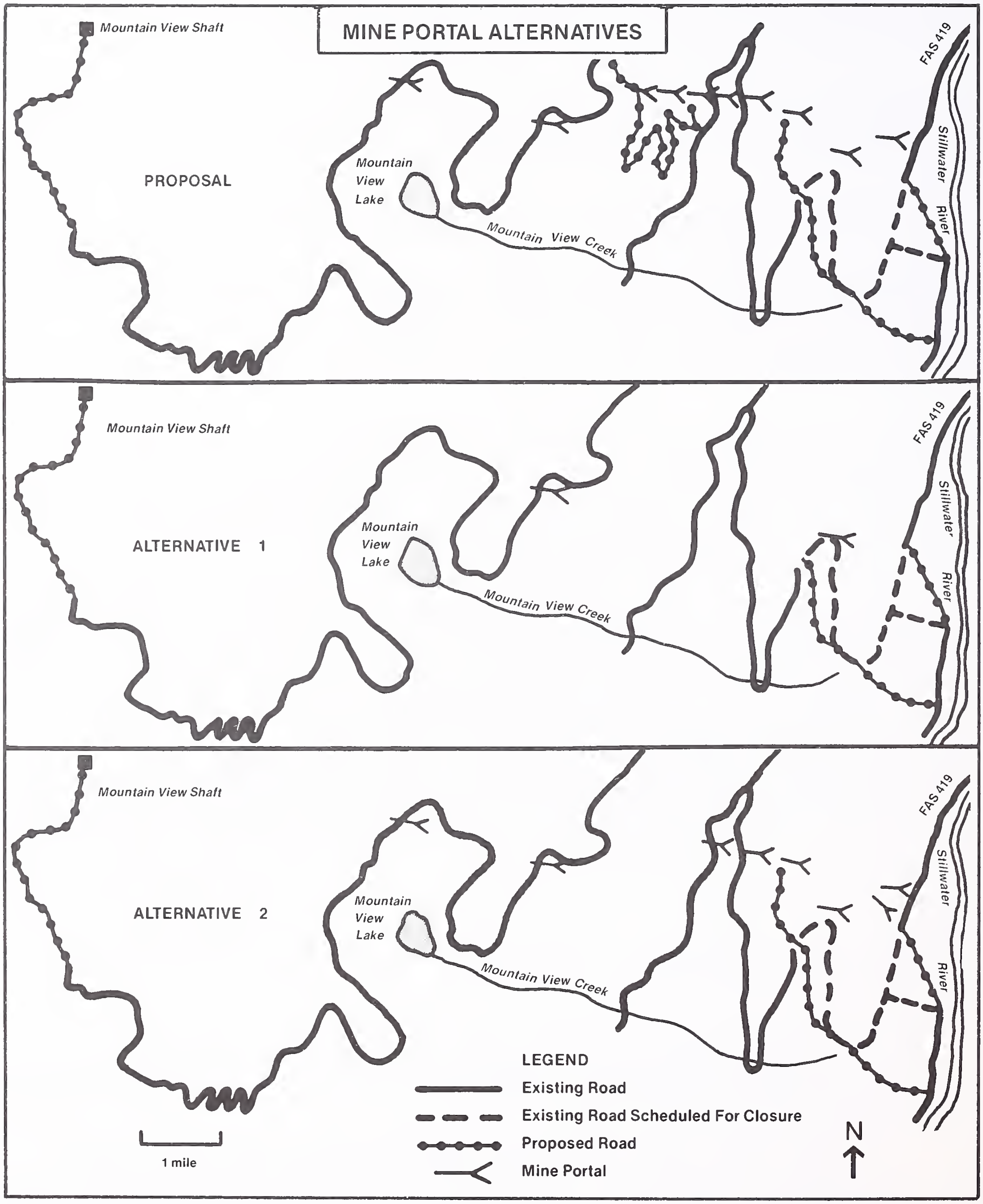

FIGURE I-2

Stillwater Mining Company proposes to use 11 portals to serve the underground workings. The EIS analyzes two alternatives: 8 portals and 2 portals. Reducing the number of portals would eliminate some new road construction.

TABLE I-2

Summary of Impacts from Mine Portals

	Proposal (11 portals)	Alternative 1 (2 Portals)	Alternative 2 (8 Portals)
Visual	Apparent visual intrusion from portals, access roads, and 13-kV power line.	Visual intrusion moderated by fewer portals, access roads, and alternate routing of 13-kV power line.	Slightly less, but similar visual intrusion compared to the proposal.

Cost of alternatives 1 and 2 could range 20 to 200 percent greater than the proposal. The added costs would not appreciably reduce the visual impact of the project.

Power Supply Options

The Choices

The existing 50-kV (kilovolt) system serving the minesite could not adequately handle the 6 megawatts of electricity required by the proposed operation. Among the alternatives for supplying reliable power to the mine are construction of a new 161-kV transmission line and generating electricity on site.

Two alternative corridors for the 161-kV transmission line have been proposed by Montana Power Company (fig. I-3). In alternative 1 the transmission line would be constructed to a substation in Nye in a corridor from the existing 161-kV Anaconda-Billings transmission line at Big Timber. In alternative 2 the power line would be constructed to Nye in a corridor extending from the existing Anaconda-Billings 161-kV line at Big Sheep Creek. Both alternatives would use the existing line from Nye to the minesite.

In the third alternative, electricity could be generated at the mine rather than supplied by a new power line. Such a generating facility would probably be an oil-fired, 7.4-megawatt turbine generator (see table I-3).

The Preferred Power Supply Option

The Montana Power Company (MPC) will submit in 1985 an application for construction of a 161-kV power line (pursuant to the Montana Major Facility Site Act) to the Department of Natural Resources and Conservation (DNRC) and the Department of Health and Environmental Sciences (DHES). The plan contained in the application will be subjected to extensive environmental study in which the agencies will evaluate alternative power-line routes and power supply alternatives. A preferred power supply alternative cannot be reliably

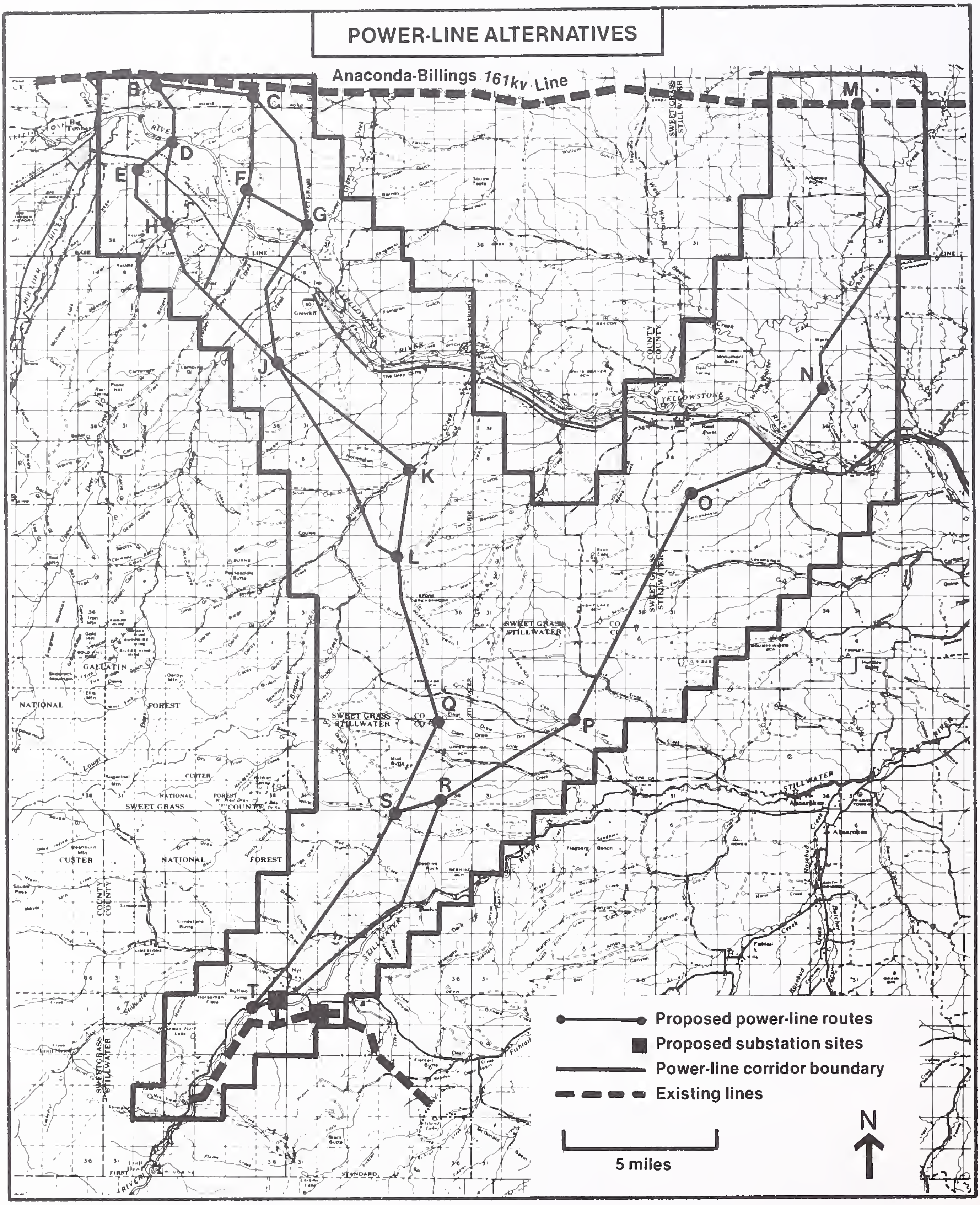

FIGURE I-3

Montana Power Company has identified two alternative corridors for the 161-kilovolt power line that is proposed to serve the project. Within each corridor the company is examining a variety of routes.

TABLE I-3

Comparison of the Power Supply Alternatives

	Big Timber Corridor (Alternative 1)	Sheep Creek Corridor (Alternative 2)	On-Site Generation (Alternative 3)
Air quality	No impacts	No impacts	Increase in SO_2, NO_x emissions.
Visual	Substation visible from FAS 419 and 420. Some line segments visible from I-90, FAS 419 and 420.	Same as alternative 1.	Visible from FAS 419 at minesite.
Reclamation	Would cross about 7.2 miles of highly erosive soils.	Would cross about 5.8 miles of highly erosive soils.	Slightly increase the amount of acreage occupied by the project.
Threatened and Endangered Species	Potential for nest desertion if peregrine falcons use historic site.	Peregrine falcons not affected.	Peregrine falcons not affected.
Noise	No impacts.	No impacts.	Negligible impacts.
Transportation	Temporary, minor increases in construction-related traffic.	Temporary, minor increases in construction-related traffic.	Added truck traffic over life of mine (fuel-oil trucks).

Note: SO_2 = sulfur dioxide; NO_x = nitrogen oxides.

identified until DNRC completes a thorough analysis of present and future load demands of the Stillwater area, the service capacities of alternatives, the environmental impacts, and the costs. An environmental impact statement will also be prepared by DNRC. After the EIS, the Boards of each department would decide whether or not to issue the Certificate of Need and Environmental Compatibility that is required for construction of the 161-kV power line.

Road Access to the West Fork Stillwater River

The Choices

Stillwater Mining Company proposes to realign FAS 419 and FR 846 around the toe of the proposed tailings dam (fig. I-2). Another short segment of FR 846 would also be relocated around the mine buildings west of the tailings pond. Public access to the West Fork of the Stillwater, however, would continue via these roads through the proposed mine-mill complex (fig. I-2).

I-10 / Preferred Road Access

Reconstructing a short segment of road and constructing a bridge across the West Fork of the Stillwater River between the Picket Pin Creek Road (FR 140) and FR 846 (fig. I-4) would provide an alternative for public access to the West Fork of the Stillwater. This alternative would prevent the public from passing through Stillwater Mining Company's mine-mill complex (see table I-4).

The Preferred Road Access

The preferred alternative for access to the West Fork of the Stillwater is the continued use of FR 846 as proposed by the company.

Six selection criteria were used to evaluate the two access alternatives.

1) Public Safety. Potential public safety hazards and conflicts with Stillwater Mining Company operations should be minimized.

TABLE I-4

Comparison of the Road Access Alternatives

	Proposal	Picket Pin Creek Road
Visual	Offers greatest visual impact to public accessing West Fork of the Stillwater.	Offers least visual impact to public accessing West Fork of the Stillwater.
Transportation	Offers inconvenience and delays to public accessing West Fork of Stillwater.	No inconvenience or delays to public accessing West Fork of Stillwater.
	Shorter route to trailhead of the West Fork of Stillwater River.	Longer route to trailhead of West Fork of the Stillwater River.
Public Safety	Introduce potential for conflicts between mine traffic and public traffic.	No conflicts between mine traffic and public traffic.
Ownership	No land acquisition required.	Require acquisition of private land.
Wildlife	Minor intrusion on Horseman Flats' elk habitat.	Minor intrusion on Picket Pin elk habitat.
Threatened and Endangered Species	No impact.	May affect potential peregrine falcon nest site selection.
Cost	Minimal.	$150,000-$200,000 including land-acquisition costs.

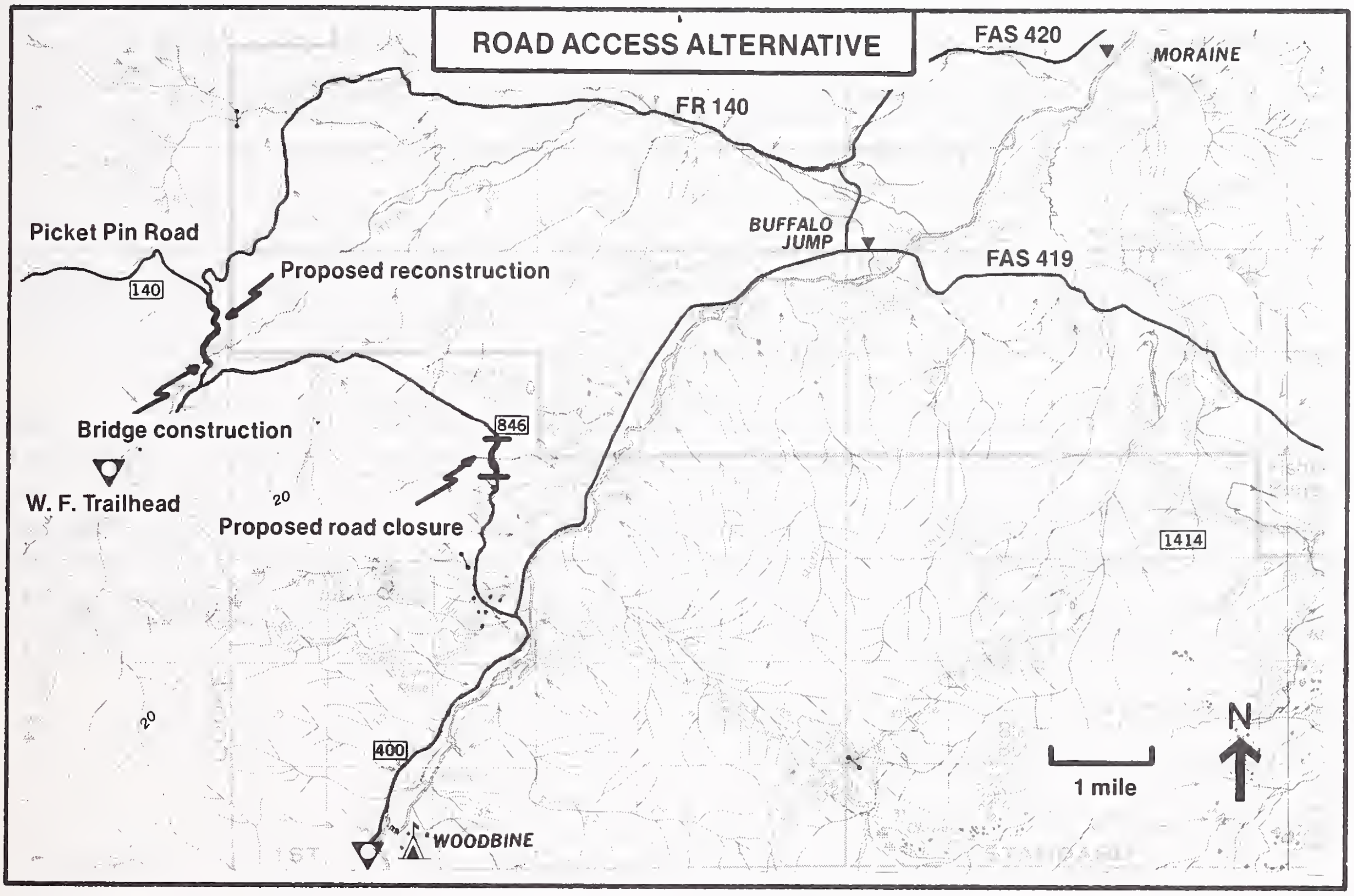

FIGURE I-4

Stillwater Mining Company proposes to maintain FR 846 as the access route to the West Fork of the Stillwater River. As an alternative, access could be provided by FR 140 and a segment of road that is now abandoned. The alternative would eliminate public traffic through the minesite.

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2) Transportation. Inconveniences and delays for forest users traveling to the West Fork trailhead should be limited.

3) Threatened and Endangered Wildlife. Adverse effects on threatened and endangered species must be mitigable as required by the Endangered Species Act.

4) Cost. The cost of environmental mitigation must be worth the public benefit.

5) Visual. Exposure of the mineral development activities to recreationists should be minimized.

6) Necessity of Condemnation. If the proposed right-of-way crosses private property owned by a person who is unwilling to grant public access on a willing-seller basis, the concerns of the owner should be used as a factor in determining the preferred route.

Removal of public traffic from the permit area during operations would eliminate potential conflicts between mine traffic and private vehicles. Inconveniences and delays to public travel caused by construction and blasting in the permit area would be avoided by routing access over the Picket Pin Road. Added assurance of public safety would also be gained after mining because sections of FR 846 in areas of potential surface subsidence could be permanently closed to vehicle access. The Picket Pin Road would also reduce views of the mining operation for forest users driving to the West Fork trailhead.

The Picket Pin Road alternative might affect potential nest site selection by peregrine falcons because of increased vehicle traffic near the historic nesting site. Road relocation to mitigate the impact would probably be infeasible.

Benefits of public safety, convenience, and scenic preservation would be achieved at an approximate cost of $150,000 to $200,000. The cost does not include road relocation to avoid the peregrine falcon cliff complex. The cost would stem from road reconstruction, bridge construction, and right-of-way acquisition. Right-of-way would have to be acquired before Stillwater Mining Company could implement the preferred road access. The present owners, however, are unwilling to sell right-of-way that would be required to construct the alternate road access.

NO-ACTION ALTERNATIVE

For the no-action alternative it is assumed that the agencies would deny the permit. If agencies denied the permit, the conditions described in Chapter III--Existing Environment would continue. However, denial would not necessarily preclude future applications for mining or development of the Stillwater Complex.

Effects on the Physical and Biological Environment

As a result of permit denial the risk of tailings dam failure and surface subsidence would be avoided. The heightened visual impact of the large impoundment, mill, additional portals, and associated facilities would also be avoided, although existing disturbances due to mineral exploration and past mining would continue to alter the landscape. Denial would avoid disturbance of an additional 94 acres of vegetation at the minesite, most of which would be open-forest vegetation types. In addition, previously disturbed acres within the project area would not be reclaimed. Denial would avoid removal of a small amount of habitat for bighorn sheep, mule deer, and other wildlife species, all of which are previously disturbed or noncritical habitats. Also, the bighorn sheep herd would not be adversely affected by the project. Displacement of mule deer and bighorn sheep into surrounding habitats due to the project would be avoided. Wildlife road kills would increase, but at a lower rate than with the project. Fishing pressure would also increase commensurate with baseline population and recreational trends for Stillwater County.

Effects of the Economic and Social Environment

Denial would forgo as many as 223 permanent jobs in Stillwater County of which about 89 would be filled by local residents.

Stillwater County per capita income would grow at a modest rate and would continue to be affected by the year-to-year variations in agricultural income.

Taxable value of property in Stillwater County would not increase as a result of the project. Thus, over the life of the project, the county would forgo more than $4 million dollars in revenues as a result of denial. In addition, the state would forgo annual revenues from metalliferous license tax revenues and resource indemnity trust tax revenues.

Expansion of solid waste, water and sewer, and law enforcement services, and additional staff for schools and the county to accommodate increased populations would not be necessary. The communities of Absarokee and Columbus would not experience the population increases the project would bring about. Over the next 15 years, populations would increase only slightly. The area roads would experience small increases in traffic. Accident rates would probably continue to remain higher than the overall state rate.

THE PREFERRED ALTERNATIVE

The agencies' preferred alternative consists of a 4-part package, plus mitigating measures.

1) Production System. The agencies prefer the proposed mining method and tailings impoundment.

2) Mine Portal Arrangement. The agencies prefer the proposed arrangement of 11 mountainside portals.

3) Access to the West Fork of the Stillwater Trailhead. The agencies prefer the continued use of FR 846 for access to the west fork of the Stillwater River trailhead.

4) Power Supply. Until Montana Power Company submits an application for a Certificate of Need and Environmental Compatibility to the Department of Natural Resources for construction of a power line, the agencies cannot choose a preferred power supply alternative.

5) Mitigating Measures. Prior to publication of the final environmental impact statement, SMC amended its application to include the agencies' mitigating measures as follows:

    A. SMC will annually report to the Department of State Lands (DSL) and the U.S. Forest Service (USFS) the result of crown pillar testing in stopes not mined by cut-and-fill stoping including, if necessary, such remedial actions taken to provide postmining support to prevent surface subsidence. SMC will submit such crown pillar data to an independent testing company for review and comment if requested to do so by the DSL and USFS.

B. SMC will prepare for DSL and USFS approval, a water quality compliance monitoring plan. The plan will specify monitoring sites, sampling frequency, parameters, sampling and analytical methods and reporting procedures that will be used to analyze ground and surface water potentially affected by the project. SMC will implement the plan in accordance with a schedule outlined in the plan. The initial phase of the monitoring program will be outlined in the plan. The initial phase of the monitoring program will be implemented concurrently with the beginning of mine development activity undertaken under the Operating Permit and approved Plan of Operations.

C. SMC will prepare for DSL and USFS approval, a spring-flow monitoring program to collect hydrologic data designed to ascertain the effects of mine development on nearby springs. The plan will specify springs to be monitored, monitoring methods, frequency of monitoring and reporting requirements. The initial phase of the monitoring program will be implemented concurrently with the beginning of mine development activity undertaken under the Operating Permit and approved Plan of Operations.

D. SMC will submit a detailed engineering report, including plans and specifications pertaining to the proposed tailings impoundment, to the DSL and USFS for review and approval prior to initiating construction of the tailings impoundment. The report will provide engineering design information that at a minimum will:

1. Fully describe SMC plans for construction of the minesite tailings disposal impoundment for the planned life of the impoundment including specific design criteria.
2. Demonstrate that the properties of available materials for embankment construction are adequate to meet design requirements.
3. Demonstrate that proper construction practices (i.e., lift height, compaction, etc.) will be used to ensure that the design requirements for stability are met.
4. Outline a tailings impoundment embankment and foundation monitoring program to provide for detection of potential instability problems.
5. Outline a tailings impoundment spill contingency plan describing leak detection and spill-control procedures.
6. Demonstrate that the tailings embankment is being built to design standards by providing a schedule for performing regular inspections of the material to be used in embankment construction and for reporting the results of the inspections annually to the DSL and USFS.

E. SMC will salvage soils from the tailings impoundment area, and other disturbed areas as feasible, in two lifts and stockpile subsoils and topsoils separately to the extent practical. Two lift soil salvage will be undertaken when there is a clear distinction between topsoil and subsoil.

F. SMC will prepare for DSL and USFS approval a plan to monitor the effects of mine development and operation on the Stillwater bighorn sheep herd. The plan will describe the objectives, methods, cooperative work schedules and reporting requirements for undertaking such studies and will outline a bighorn sheep impact mitigation contingency plan. The plan shall be submitted for agency review prior to initiating mine development activity undertaken under the Operating Permit and approved Plan of Operations. Initial research activity specified in the plan such as vehicular traffic monitoring along FAS 419 in the area of the bighorn sheep wintering range will be implemented prior to mine development. Approval of the full monitoring and impact mitigation contingency plan will be obtained from the DSL and USFS within 90 days of the date of approval of the Plan of Operations by the USFS.

G. SMC will carry out an employee education program about the adverse effects of disturbance on bighorn sheep and discourage nonessential entry into bighorn range during winter months.

H. SMC will periodically survey employees as to their family recreation patterns of usage in the Stillwater River basin and provide such data to the Department of Fish, Wildlife and Parks for assessment of fishing pressure and use of fishing access sites.

I. SMC will increase the seeding rate specified in the Application for Operating Permit for portions of high altitude (above 5,300 feet) lands disturbed by mining. Herbaceous groundcover and woody plant survival will be evaluated and if excessive bare ground or erosion is observed, the ground will be reseeded.

J. SMC will provide the USFS specific design information for the relocated sections of FAS 419 and FR 846 for review and approval prior to undertaking construction of the relocated roadways.

K. SMC will enter into a road maintenance agreement with Stillwater County for that portion of FAS 419 which is to be used by trucks hauling ore and with the USFS for that portion of FR 846 similarly used.

L. SMC will provide the USFS with engineered plans and typical cross-sections for the design of adit site yard areas and new adit site access roads on USFS land for review and approval prior to road or yard area construction.

M. SMC will implement an employee bussing or van/car pooling program with a target of reducing the traffic on FAS 419 to 1/3 of the number of vehicle trips that could be expected if each worker commuted individually to the workplace. The results of this program will be reported annually to the U.S. Forest Service and the DSL. In the event that the targeted reduction in traffic levels on FAS 419 is consistently not achieved by the bussing and car/van pooling program for any year of mine operations and the DSL and USFS determine that additional mitigating measures are necessary, SMC will undertake additional mitigation directed toward achieving the targeted traffic-reduction goal.

N. SMC will refertilize all seeded areas one year after initial seeding if necessary and will restrict domestic animal grazing on reclaimed areas for at least 2 years after initial revegetation to the extent possible on lands owned or controlled by SMC.

O. SMC will take measures to reduce the visibility of project operations by planting mixed conifer shelter belts along the west side of FAS 419 and along the northern boundary of project operations. Such shelter belts will be planted along the highway and along the northern property boundary in a manner designed to lessen the visibility of project activities from vehicles traveling along FAS 419. In addition, SMC will use natural poles and insulators in constructing the electric transmission line between the mill substation and the Mountain View shaft site.

STILLWATER PROJECT: PROPOSAL AND ALTERNATIVES

The alternatives covered in this EIS have been divided into four groups: production systems, power-supply options, mine portal arrangements, and public access routes to the West Fork of the Stillwater River. Each of these groups is analyzed separately in chapters IV and V.

For the first group--production systems--the proposal and two alternatives include different tailings impoundment locations and associated pipelines to slurry tailings wastes. The power-supply options include two alternative transmission-line corridors and on-site electrical generation. Different numbers of mine openings are included in two portal arrangement alternatives. Finally, an alternate public access to the West Fork of the Stillwater River trailhead is included as a road-access option.

STILLWATER MINING COMPANY'S PROPOSAL

Stillwater Mining Company (SMC) would develop its platinum-palladium mine in two phases; the mill would not be constructed until the second phase of mine development. Initially, the mill would produce at a rate of 500 tons per day and would increase to 1,000 tons per day if SMC decided to expand its operations. At full production, the mill would extract 20 tons of concentrate. One truck would haul the concentrate to Columbus each day. A train would haul the concentrate to a smelter for final refining. About 980 tons per day of mill tailings would be left behind; about one half of this would be dumped into an impoundment at the mill site. The remaining coarse fraction of the tailings would be returned to the mine to fill the stopes as mining progressed. The operation would last about 30 years, including 2 to 3 years for construction, 25 years for operation, and 3 years for reclamation. The company would extract about one-half troy ounce of platinum-group metals from each ton of ore. (Platinum-group metals include platinum, palladium, iridium, rhodium, ruthenium, and osmium.)

The project would lie within a 550-acre permit area, of which only 152 acres would actually be disturbed by construction and operations (table II-1). The permit area would cover parts of sections 16, 17, 18, 19, 20, and 21 of T5S, R15E (figs. II-1 and II-2). The area lies on both U.S. Forest Service and private (Stillwater Mining Company) land (fig. II-3 and II-4). The private land would be used mainly for the mill and tailings impoundment; the Forest Service land mainly for the mine. Much of the operation would cover land disturbed by previous mining.

Project Development

Mine development would begin with the excavation of the 5,000-foot and 5,350-foot-level portals and developing the underground workings for these and the Minneapolis Adit. This level of development would occur for about one

TABLE II-1
Surface Area Disturbance

Facilities	Acres
Mine portals, shaft, and yard area	14
New access road construction	27
Mill, mine support facilities, and tailings impoundment	81
Topsoil storage area	6
Percolation ponds	10
Misc. (tanks, parking, transmission line, etc.)	14
Total Disturbed Area	152
Undisturbed Permit Area	398
Total Permit Area	550

Source: Stillwater Mining Company, 1984a.

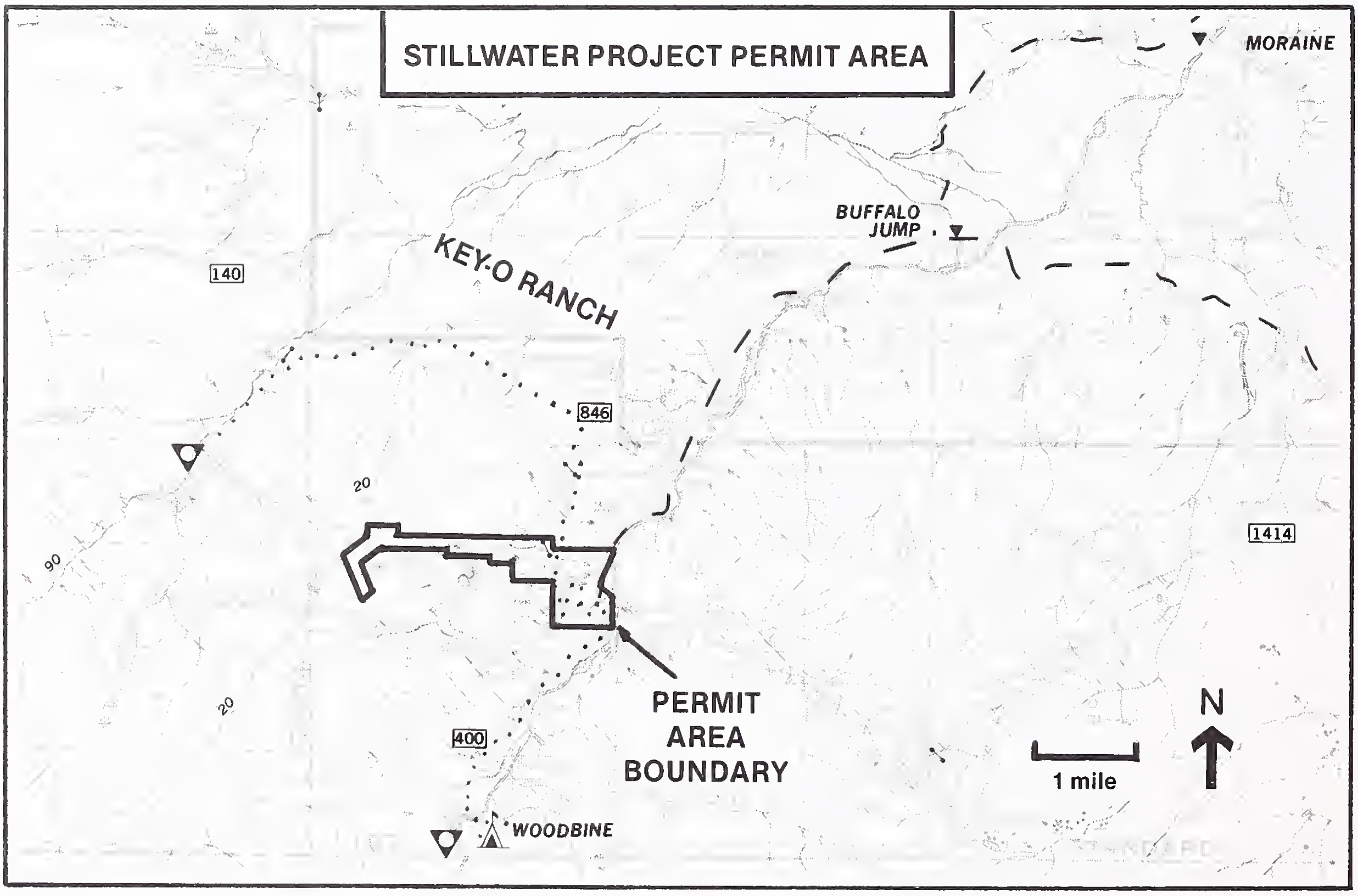


FIGURE II-1

The 550-acre permit area lies near the former Mouat Mine, just north of the Beartooth Ranch and Woodbine Campground. Although the project site is contained entirely within the national forest boundary, much of the permit area lies on private inholdings.

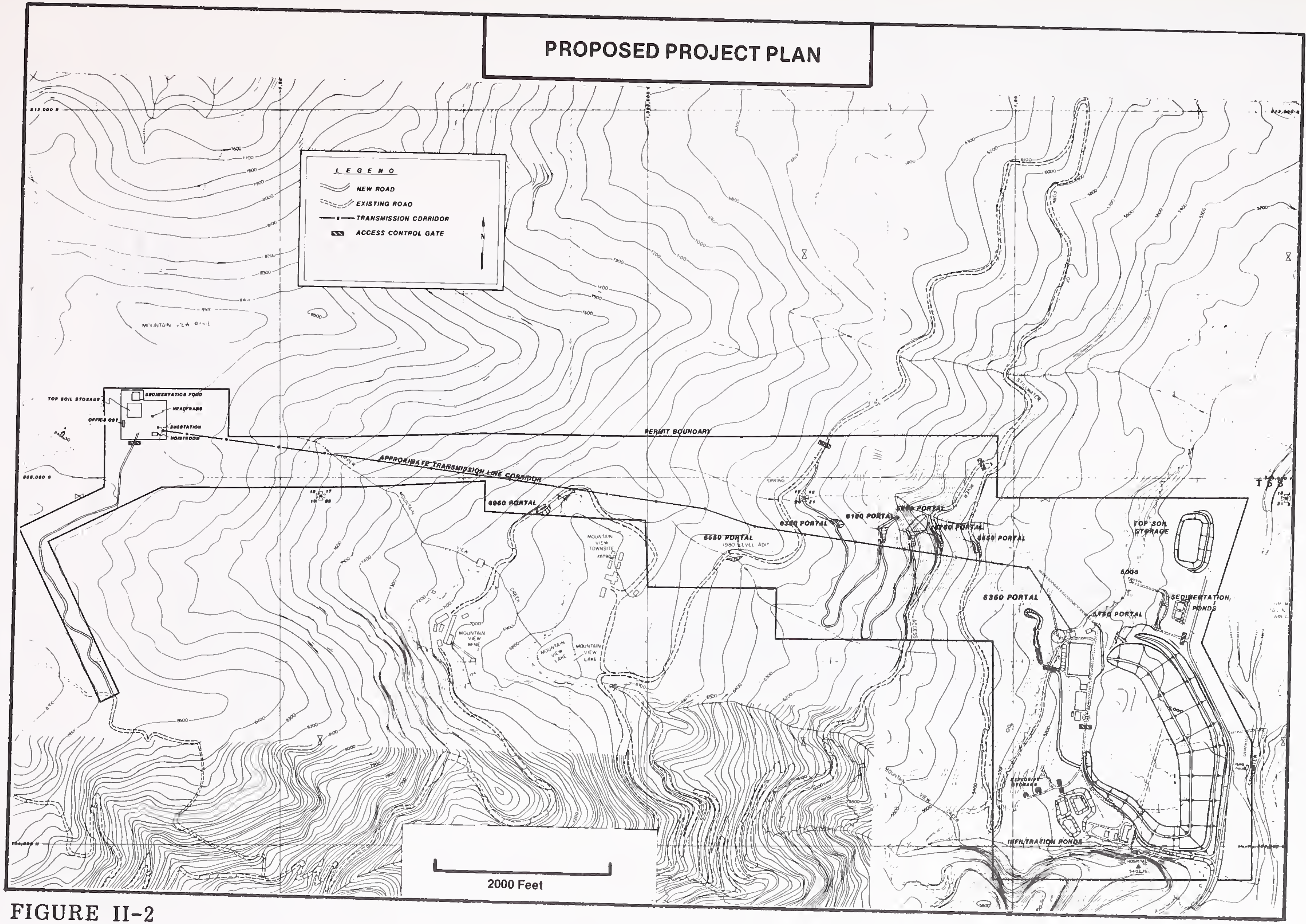


FIGURE II-2

The major components of Stillwater Mining Company's plan include the 11 portals, the 70-acre tailings pond, and the milling facilities. The permit area extends from just west of the Stillwater River to the top of Mountain View Ridge.

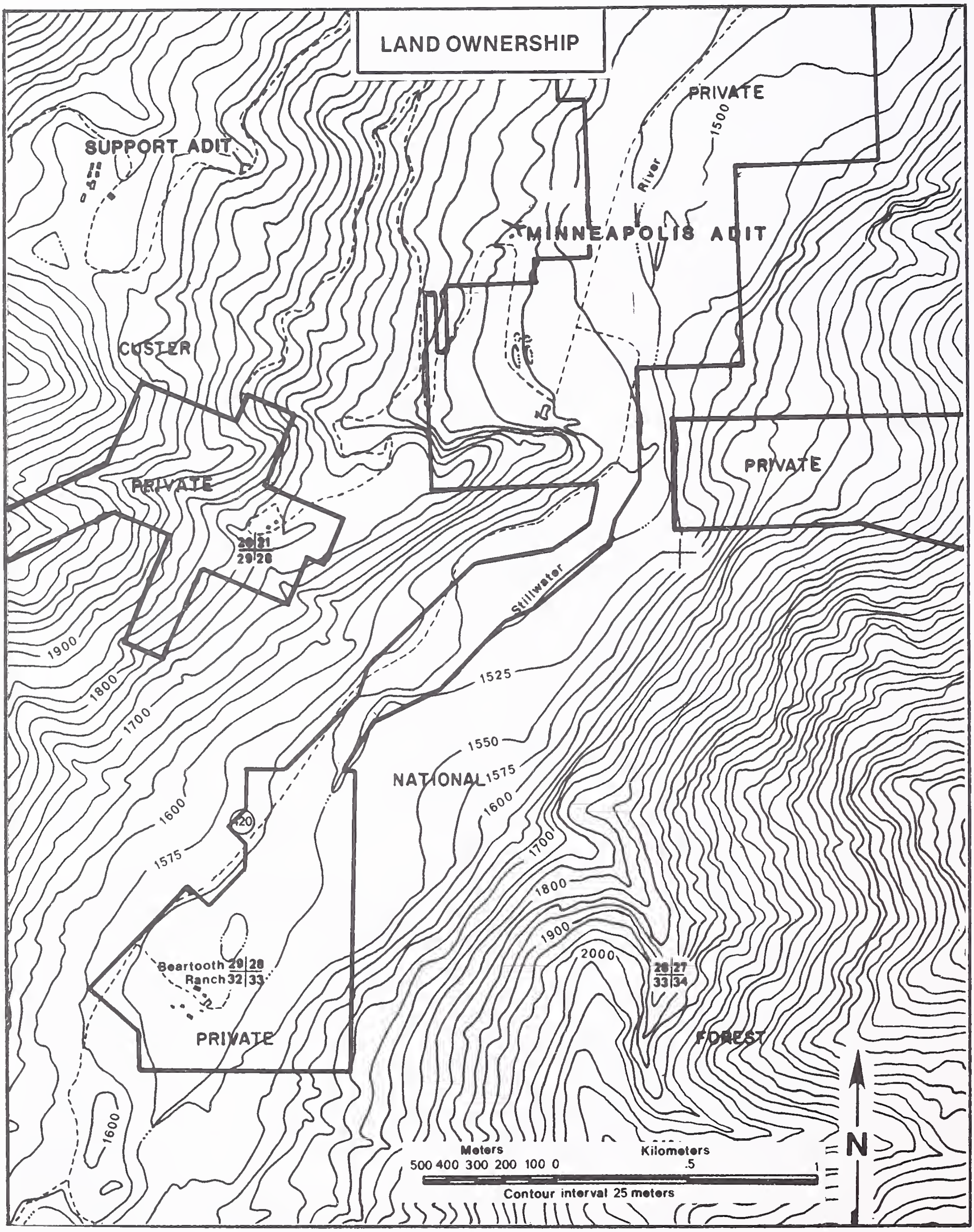


FIGURE II-3

The project would occupy both private and national forest system land. Most of the portals would be on forest land, most of the facilities on private (Stillwater Mining Company) land.

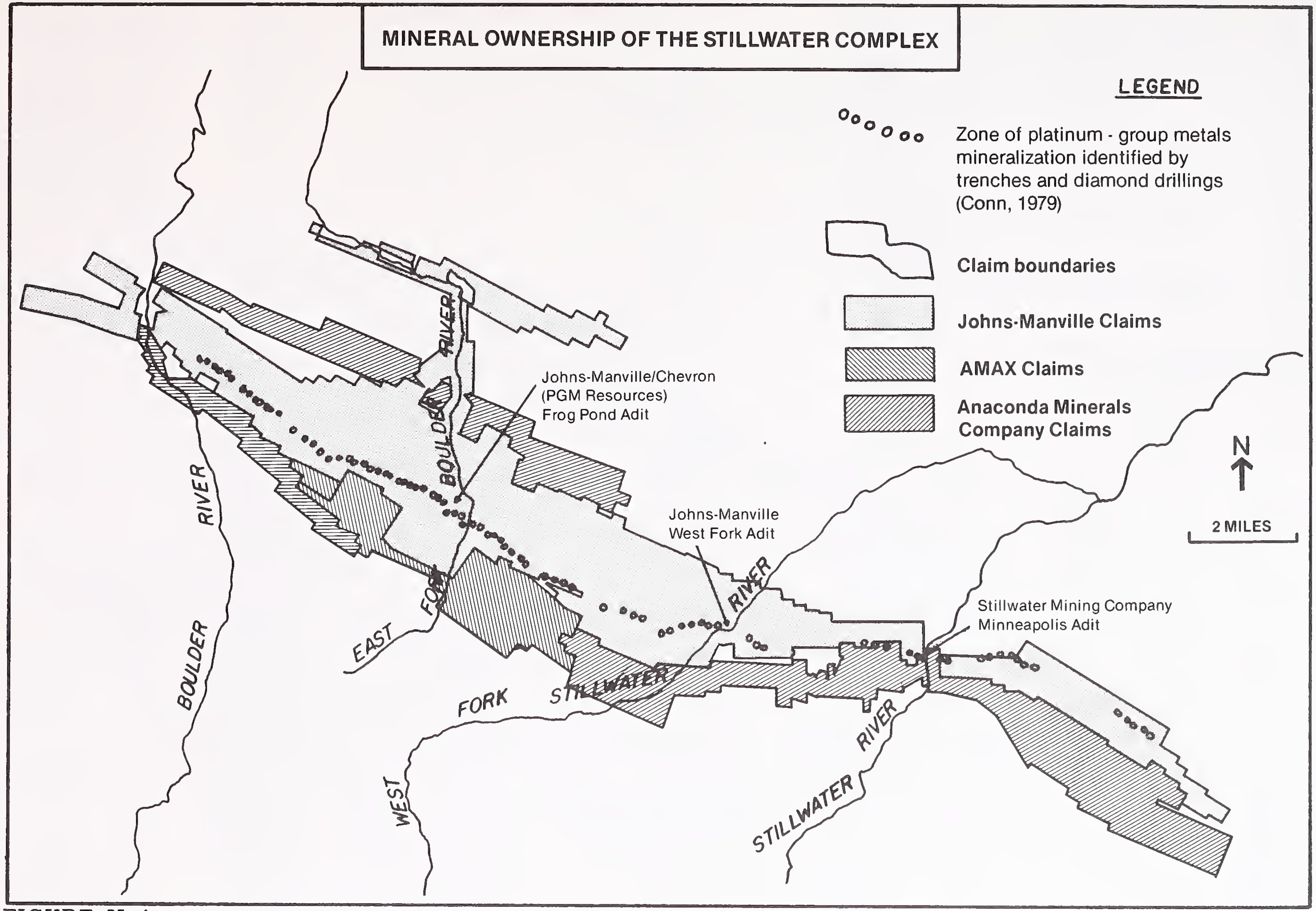

MINERAL OWNERSHIP OF THE STILLWATER COMPLEX
LEGEND
Zone of platinum - group metals mineralization identified by trenches and diamond drillings (Conn, 1979)
Claim boundaries
Johns-Manville Claims
AMAX Claims
Anaconda Minerals Company Claims
N
2 MILES
Johns-Manville/Chevron (PGM Resources) Frog Pond Adit
Johns-Manville West Fork Adit
Stillwater Mining Company Minneapolis Adit
BOULDER RIVER
BOULDER RIVER
EAST FORK
WEST FORK
STILLWATER RIVER
STILLWATER RIVER

FIGURE II-4

The Stillwater Complex extends for 28 miles across four drainages. Three companies, Manville Products Company, AMAX, and Anaconda Minerals Company, hold most of the claims to the complex.

year. Ore removed during this period would be stockpiled on the existing asphalt pad adjacent to FAS 419. Waste rock from the mine would be used to construct portal yard areas and roads. During this development phase, the mine would employ from 100 to 150 workers.

About one year after, SMC would begin construction of the mill and tailings pond if the information collected during the first phase were positive for full project development. Mine development would continue with opening the 5,550-level portals and underground work from this and other portals. Waste rock from this phase of development would be used for road construction, portal yard areas, and initial construction of the tailings dam. Ore would be stockpiled on the asphalt pad. Workforce levels would peak at about 300 employees.

Mill construction would require about 12 to 15 months. The mill would begin producing at a rate of 500 tons per day and would continue at this rate possibly until 1989-1990. Full production of 1,000 tons per day would not occur until 1991 or later. Employment levels for the 500-tons-per-day operations would be about 200 workers. Employment levels would be somewhat greater than 220 workers in the full-production operation, primarily due to additional labor for cut-and-fill mining.

Mining Plan

Ore would be mined primarily by cut-and-fill stoping. In this method of mining, the coarser, sand fraction of the mill tailings would be pumped (backfilled) into the mine to fill the stopes as mining progressed. The tailings would be pumped from the mill as a slurry. In the mine, cement would be added to the slurry to produce a solid surface on which miners can stand. The sand fill would stabilize the walls and prevent spalling rock from diluting the mined ore, the major advantage of cut-and-fill stoping for the Stillwater Project. Miners would excavate individual chambers, or stopes, in the platinum reef (fig. II-5). Ore would be blasted from the stope ceiling, one layer at a time. The miners would stand on fill material consisting of the coarse fraction of mill tailings to set each round of charges. After each blast, the ore would be drawn to vertical chutes developed within each stope making room for the miners to work the next round (fig. II-6). As fill material is added to the stopes, the chutes would be extended upward. Ore from the chute(s) would be loaded into mine cars on the 5,000 and 5,350 levels below.

When miners set the last charges in each stope, they would be standing on nearly 200 feet of consolidated sand fill. The ceiling of the sand-filled stope would be the floor of the mine tunnel above. Each stope would measure about 200 feet in length, 200 feet in height, and would range in width from 4 feet to 20 feet (average of 6 to 7 feet in width).

By the end of mining, SMC would have mined several hundred stopes. About 70 percent of the stopes would be filled with the coarse fraction of tailings at the end of mining. Two vertical service shafts would be developed to provide access between levels. In addition, 20 horizontal tunnels driven every 200 vertical feet (served by the 2 shafts and 11 portals), and many other minor underground chambers, tunnels, and chutes for passing ore, waste rock,

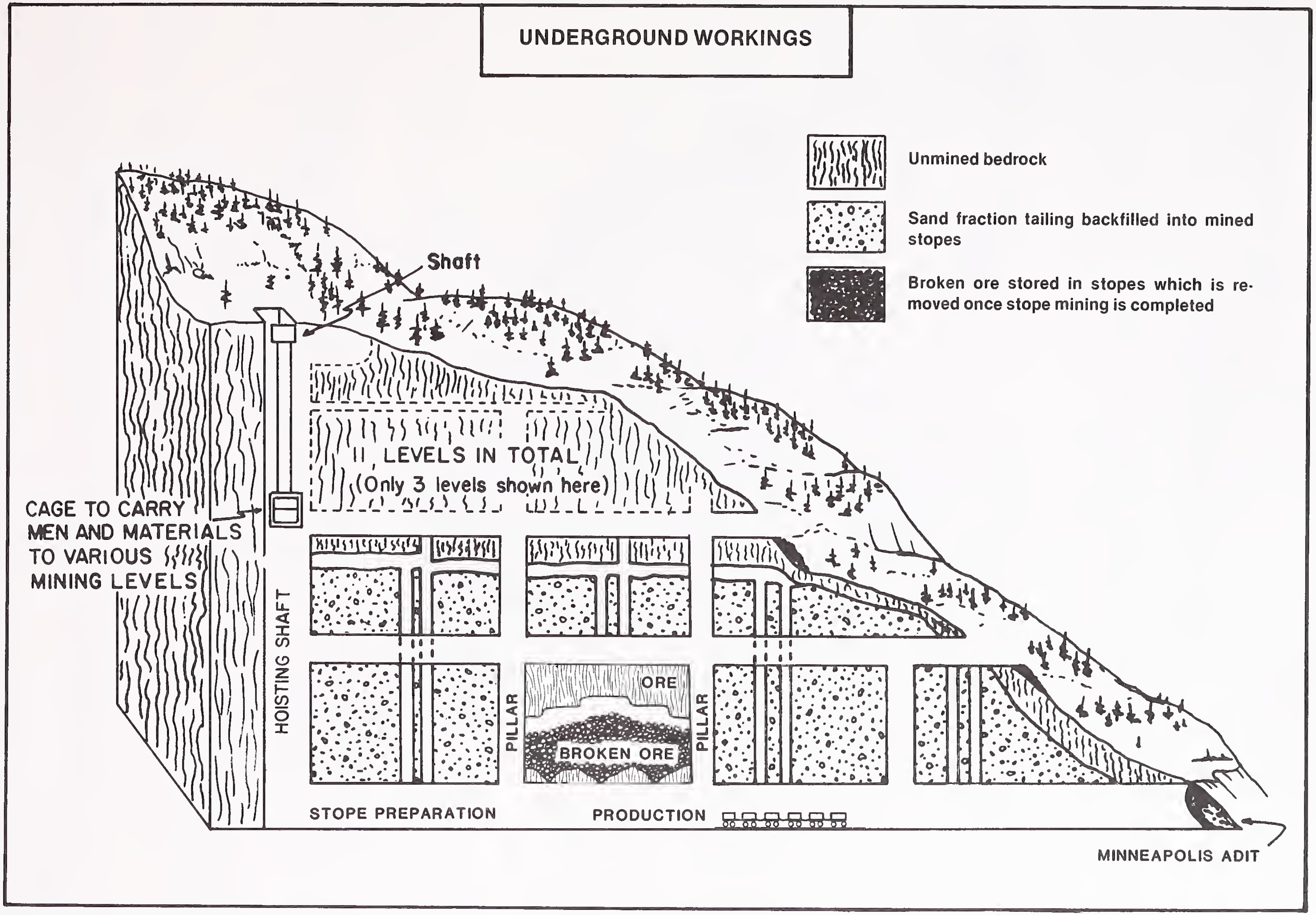

UNDERGROUND WORKINGS
Unmined bedrock
Sand fraction tailing backfilled into mined stopes
Broken ore stored in stopes which is removed once stope mining is completed
Shaft
11 LEVELS IN TOTAL
(Only 3 levels shown here)
CAGE TO CARRY MEN AND MATERIALS TO VARIOUS MINING LEVELS
HOISTING SHAFT
PILLAR
ORE
BROKEN ORE
PILLAR
STOPE PREPARATION
PRODUCTION
MINNEAPOLIS ADIT

FIGURE II-5

The platinum ore would be mined from a series of individual chambers, or stopes. Along the bottom of each stope would be a mine tunnel. Eleven tunnels would reach the surface. Although the simplified sketch shows only seven stopes, the mine would eventually have hundreds.

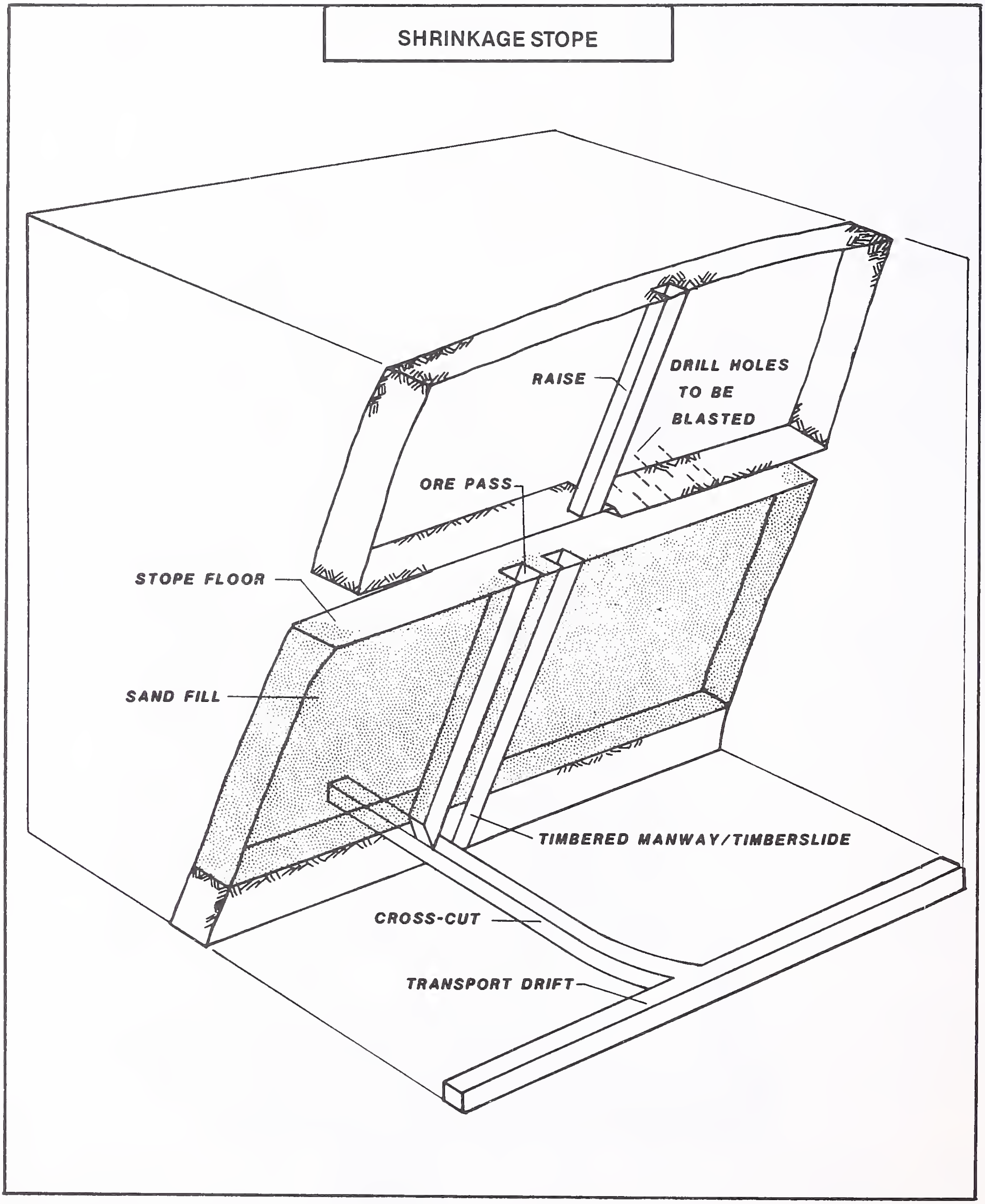


FIGURE II-6

Cut-and-fill stopes would be developed from a vertical raise. Raises would be extended into the overlying stopes as development progresses upward. Each raise would contain a manway for personnel access and a timberline compartment for moving materials and supplies. Parallel to each raise would be an ore chute to transfer ore from the stope into mine cars on the level below. Each stope would dip, or lean, with the angle of the mineralized zone.

workers, and equipment, would be constructed within the mine. These additional openings would not be backfilled.

A small percentage of the stopes would be mined by shrinkage-stoping methods where ore is withdrawn from the bottom of the stopes instead of from the sides as in cut-and-fill stoping. The miners would work off of broken ore rather than backfilled tailings. The empty stopes would be backfilled with tailings or waste rock, or left empty after the ore is removed from the stopes.

To prevent surface subsidence, the company would leave a 20- to 50-foot solid rock roof (known as the crown pillar) over the entire mine cavity. In addition, the ceiling would be rock bolted to prevent spalling (disintegration by chipping and flaking). If the roof were to collapse and the surface subside, the company would bridge or fill the resulting holes or depressions.

Any stopes below the crown pillar not mined using the cut-and-fill method would be backfilled if they required additional postmining support to prevent subsidence.

The complexity of the underground workings would not be visible outside the mine. Only 11 tunnel portals (including two now used for exploration) and one shaft on the top of Mountain View ridge near the western edge of the mine workings would reach the surface.

The Minneapolis portal (at 5,150 feet) would be the main mine entrance. Most workers and equipment would enter the mine and most ore and waste rock would leave the mine through this portal. The lowest mine portal would be the next busiest area. The lower portal would provide primary ventilation and water drainage for the mine and an exit for some waste rock and as much as 300 tons per day of ore.

The company would produce about 1,700 tons of waste rock each week. Waste rock which cannot be placed underground would be hauled to the surface for protection against erosion, building the tailings pond dam, and surfacing yards and roads.

A narrow-gauge railroad would haul both ore and waste rock to the surface. The railroad cars would dump the ore in an underground bin near the Minneapolis portal. A conveyor would then carry the ore through a tunnel to the mill stockpile.

At the lowest portal (5,000 feet), train cars would dump the ore in a stockpile. From there, 25-ton trucks would haul the ore one-half mile around the tailings pond to the mill, using both the public highway (419) and FR 846. Altogether, the ore trucks would make as many as 15 round trips per day.

Blasting for the project would be done almost entirely underground. A minor amount of surface blasting would be necessary to build access roads and open the new portals.

The main buildings for the project would be located at the Minneapolis portal (fig. II-7). The facilities would include the mill, warehouse, maintenance shops, offices, ore storage area, electrical substation, waste-water

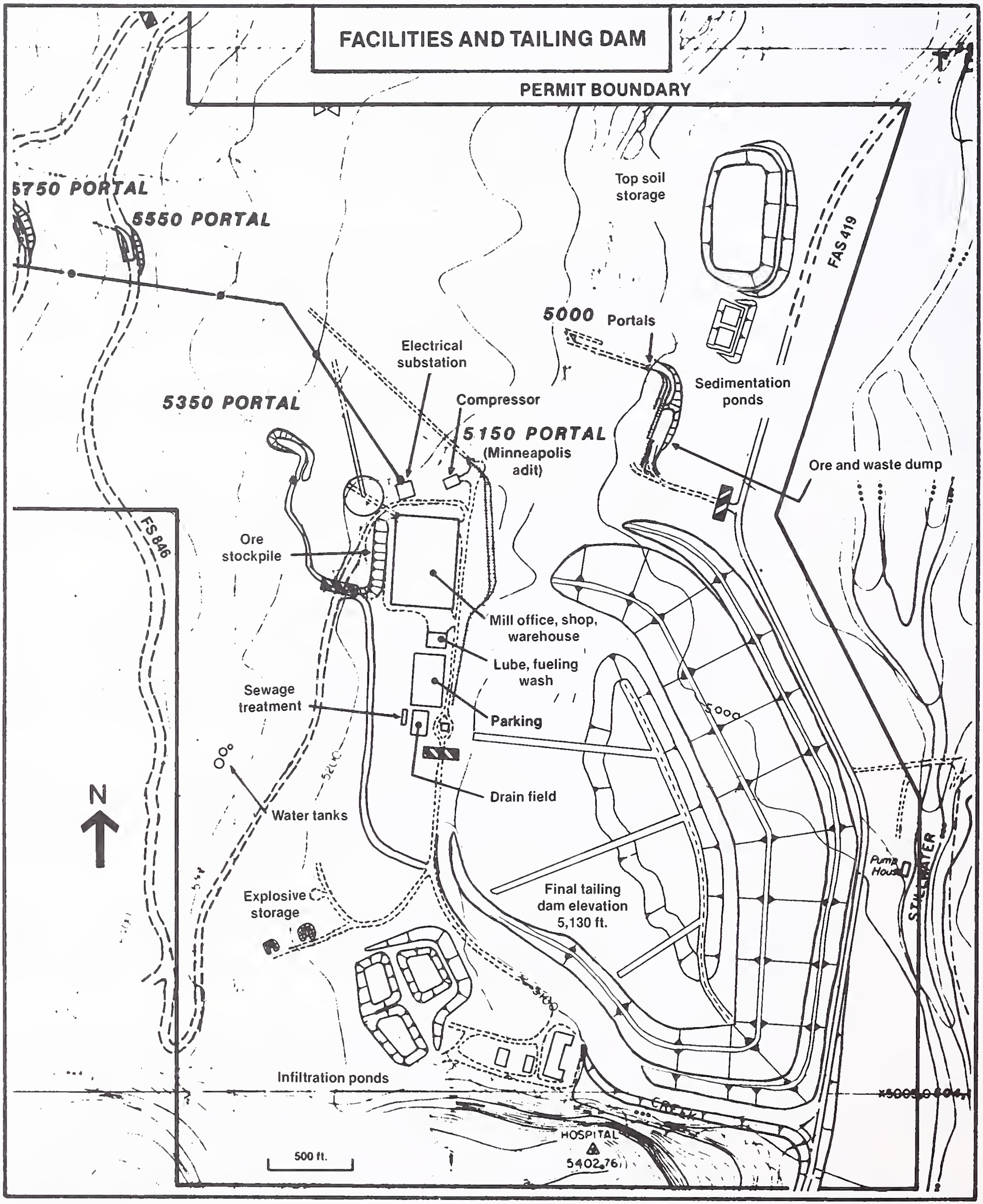


FIGURE II-7

SMC would eventually build a facilities complex to process 1,000 tons of ore per day. Over the life of the mine, 3.6 million tons of tailings would be discarded in the impoundment.

disposal system, compressor building, sandfill plant, and explosive storage facility.

The shaft, driven in mine year 12, would be equipped with a headframe, hoist building, and electrical substation. The top eight portals would each have a small service yard, rail tracks, and a steel shed. All project buildings would be painted an earth-tone color.

Milling the Ore

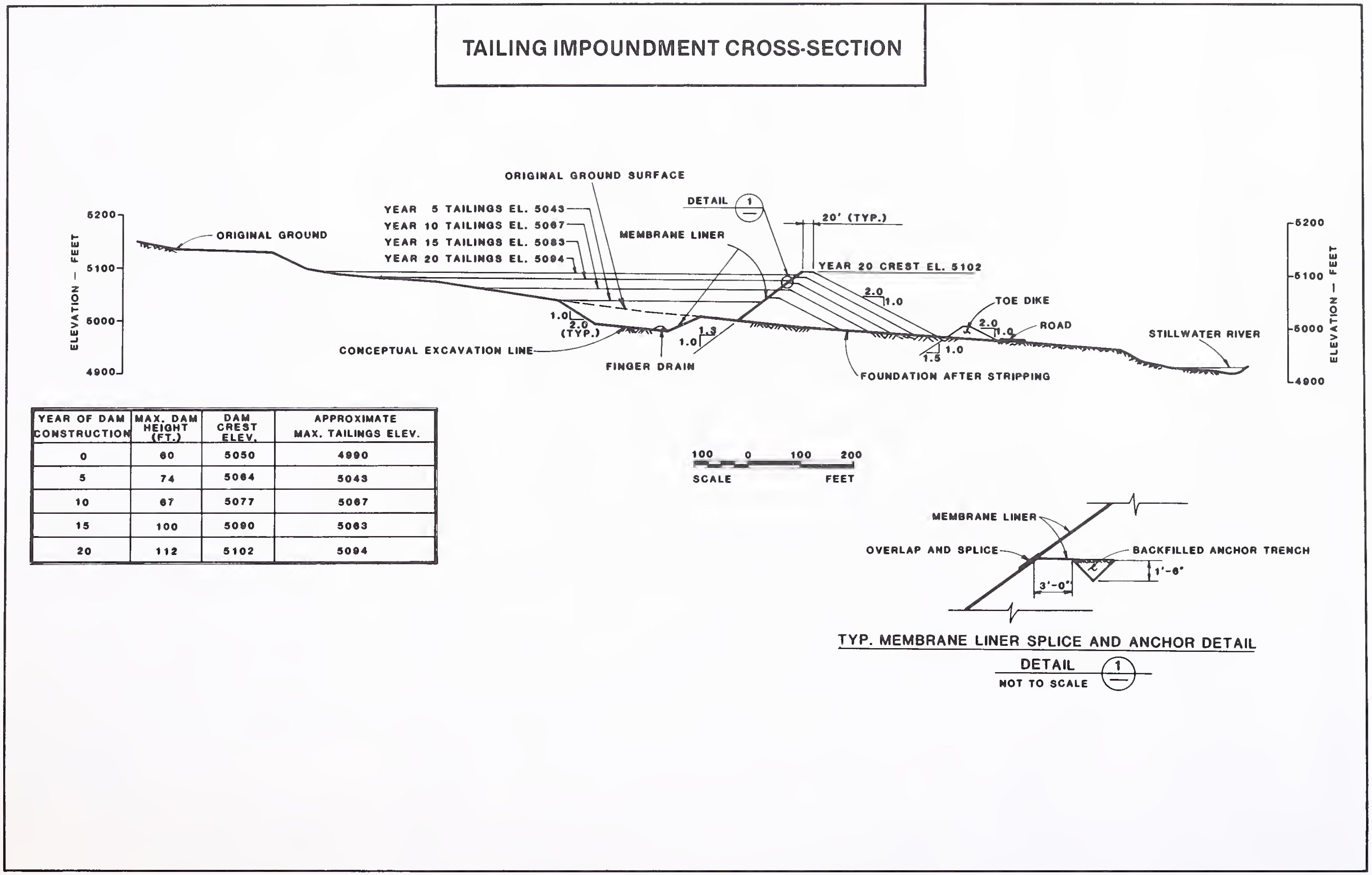
The mill facility would contain a partially enclosed ore storage area, a mill building, a loading area, and several support structures (for water storage, parking, vehicle lubrication, fueling, and wash-down).

Milling would consist of crushing, grinding, froth flotation, concentrate drying, and waste disposal. The company would retrieve the ore from the stockpile, grind it, and add water and chemicals to form a slurry of 30 percent solids. This slurry would be subjected to froth flotation, a physical-chemical method of separating and concentrating the metals in finely ground ores. During flotation, the slurry would be agitated, injected with air, and treated with a frothing agent. A froth of bubbles would result. Other chemicals (collectors) added to the slurry would create conditions favorable for the attachment of the desired minerals to the bubbles. The air bubbles would carry the minerals--sulfide minerals in this case--to the surface of a slurry pulp. The mineral-laden froth at the surface of the slurry would be skimmed off, while the other constituents in the ore rock remain submerged. The froth would then be filtered and dried to form a concentrate of precious metals. The pulp slurry left at the bottom of the flotation cells would be piped to the tailings pond for disposal. The froth flotation process would recover over 90 percent of the precious metals in the original ore. The mill would process about 330,000 tons of ore, producing 6,600 tons of concentrate, yearly. The concentrate would be containerized for shipping.

Five chemicals would be used in the milling process: potassium amyl xanthate, polypropylene glycol methyl ether, carboxy methyl cellulose, copper sulfate, and sulfuric acid (see appendix C).

The Tailings Pond

The tailings pond would be formed by a hook-shaped dam built of earth and waste rock (fig. II-8). The tailings dam would be built in stages and would have two parts--the main dam and a 25-foot-high toe dike (fig. II-8). Dam construction would require 1.8 million cubic yards of fill material. Mine waste rock would provide most of the fill material (1.13 million cubic yards), but some of the material would be excavated from within the tailings pond. Each time the dam is raised, the company would pile earth and waste rock on the dam crest and slope it toward the toe dike. The toe dike would catch sediment from the main dam and would provide a base for relocating FAS 419 and FR 846. The dam would be built using downstream construction methods.



YEAR OF DAM CONSTRUCTION	MAX. DAM HEIGHT (FT.)	DAM CREST ELEV.	APPROXIMATE MAX. TAILINGS ELEV.
0	60	5050	4990
5	74	5064	5043
10	87	5077	5067
15	100	5090	5083
20	112	5102	5094

FIGURE II-8

The tailings impoundment dam would be raised 5 times, approximately every 5 years. The material used in the dam would be obtained from excavation within the impoundment bottom or from mine waste rock. At the end of mining the dam would rise 125 feet above the highway.

An impervious liner (hypalon) would cover the pond bottom and embankment to limit seepage.

A system of finger drains would be constructed above the pond liner to help dewater the tailings at the end of mining. The drain system would be consist of three, six-foot-thick sand finger drains extending along the bottom of the pond. The finger drains would connect with a sand-collector drain. A slotted PVC pipe embedded in the sand-collector drain would connect to a non-slotted PVC pipe located at the low point of the impoundment that would exit the dam crest as a standpipe. During reclamation, water would be pumped from the drain system through the standpipe. The water would be evaporated by spraying it over the dam face or tailings surface.

A surface sand plant would separate the tailings into coarse fraction (sand) and fine slime (fractions). The coarse fraction tailings (about 4.6 million tons) would be pumped back into the mine. The company would eventually dump 3.6 million tons of fine fraction tailings into the impoundment, discharged as a slurry from spigots along the dam crest. A collection pump mounted on a barge would pipe excess water back to the mill.

To minimize wind-blown dust, the dam face would be covered with coarse rock, sprayed with water, or revegetated. In addition, the tailings pond would be kept covered with water at all times. The water depth would vary from 1 to 4.7 feet, depending mainly on water use at the mill.

By the end of mining, the pond and dam would cover 70 acres and would be about 325 feet from the Stillwater River. The dam would rise 125 feet above the highway, and the dam face would slope at an angle of 50 percent. During impoundment operation, the dam crest would be 20 feet wide.

Water Management

Water flowing into the underground mine workings would drain to the 5,000-foot level or be pumped to the surface. Pipes would direct some water to the mill, but most would go to the sediment and percolation ponds (fig. II-7). At the ponds the water would either evaporate or seep back into the ground. When in full operation, all excess mine water would leave the underground workings by either the Minneapolis or 5,000-foot-level portals.

The sediment and percolation ponds would be built with earth excavated from the site. The three ponds together would cover about 9 acres and would be capable of handling 500 gallons of water per minute. All three ponds would lie above the 100-year flood plain of the Stillwater River.

At the tailings area, ditches would catch all runoff water and divert it around the dam. For safety, however, the tailings dam would always have enough freeboard (rise high enough above the pond surface) to prevent overtopping. Mountain View Creek would not be affected; it would continue to flow as it does today.

Ordinarily, the mill would require 350 gallons of water per minute. This water would come from the underground mine workings, surface runoff, milling chemicals, precipitation, ore moisture, and water recycled from the pond. Although no additional water is expected to be needed, more could be pumped from wells, which the company plans to drill for drinking water.

Utilities

The entire project would require 6 megawatts of electricity, which the Montana Power Company (MPC) would supply to an electrical substation next to the mill. During mine development and operations, portable generators would be used as necessary to augment the existing 50-kV (kilovolt) system or provide emergency power during supply outages. Stillwater Mining Company's operation, however, would eventually require a reliable power supply. Several alternatives are available. Montana Power Company's proposal is to build a 161-kV transmission line to Nye. As an alternative, Stillwater Mining Company could construct an electrical generation facility at the minesite. These alternatives are discussed in greater detail later in this chapter (Power Alternatives) and are evaluated in Chapter V.

Within the proposed permit area, the company would install overhead lines, which would include a 2-mile-long, 13-kilovolt line, running from the substation to the shaft site at the top of Mountain View Ridge. The 13-kV line would require a 20-foot-wide corridor and would supply power both to the mountainside portals and the shaft.

Roads

Two public roads would serve the operation: public highway FAS 419 and FR 846. The highway would provide primary access (fig. II-7) and FR 846 would branch to the mill, surface facilities, and upper portals. FR 846 would remain open to the public and provide access around the operation to national forest lands and Horseman Flats.

The company would relocate three sections of road around the tailings dam: two segments of FR 846 and one segment (about 3,000 feet) of FAS 419. All three segments would be built to U.S. Forest Service or county standards. Three more sections of road would have to be built on the mountainside for access by Stillwater Mining Company to the upper portals and shaft. These private roads would have one lane with turnouts and a maximum grade of 10 percent. One portal would lie alongside FR 846; the rest would lie along roads closed to the public. All road improvement and rerouting costs would be paid by Stillwater Mining Company.

Mine Employment

In the first two years, the company and its construction contractor would hire as many as 300 people. The number of employees would decrease in year 3 to 200. Each time the company raises the tailings dam, about every 5 years after the mill reaches full production, it would temporarily hire another 20 to 50 workers.

The administrative staff would work a regular day shift, five days a week. The underground miners would work two shifts a day, five days a week. The mill workers would operate three shifts a day, seven days a week. About 89 workers would be hired locally.

Bonding

Stillwater Mining Company must file a bond with the Department of State Lands of not less than $200 and not more than $2,500 for each acre disturbed. Despite these limits, however, the bond must not be less than the estimated cost to the state of reclaiming the disturbed lands (82-4-328(1), MCA). The bond would not be released until the Department of State Lands and the U.S. Forest Service determine that reclamation has been successfully completed.

The Forest Service may require additional bonding if it feels that the bond held by the Department of State Lands is not adequate for reclamation of national forest lands or available for Forest Service requirements. The bond amount would be equal to the estimated cost of stabilizing, rehabilitating, and reclaiming the area of operations on national forest system lands. The bonding level would be adjusted if the plan of operations were modified.

Reclamation

During project construction, the company would reclaim a number of areas:

- topsoil stockpiles
- percolation pond embankments
- diversion ditches
- tailings toe dike
- cut-and-fill slopes

The percolation ponds, tailings dam toe, cut-and-fill slopes, and drainage ditches would not be disturbed again. The company would have two topsoil stockpiles, one for the tailings area and the other for the Mountain View shaft site. Both would be removed during reclamation.

After project shutdown, all equipment of value would be removed from the underground workings and sold or taken to other operations. The salvaged material would include such items as mine equipment, exhaust fans, and rails. All other material--timbers, rail ties, gates, pipe--would be left in place.

The company would also dismantle and remove all surface buildings and mine equipment, haul away or bury concrete and other debris, and plug the shaft and the highest eight of the eleven portals. The shaft could be plugged with reinforced concrete and the other portals with waste rock. Afterwards, bulldozers would grade the surface. The three portals that are not plugged would be sealed with heavy steel doors secured by hinges and hasps. If the Department of State Lands and U.S. Forest Service determine that the lowest three portals no longer have any beneficial use, these remaining openings would be plugged and reclaimed in the same way as the other portals.

After mining, water would continue to drain from the mine, leaving by the 5,000-foot portal. The percolation ponds would be left to accept the drainage. The company would maintain the ponds until the Department of State Lands and Department of Health and Environmental Sciences determine that direct discharge to the Stillwater River is acceptable.

The parts of FR 846 and the public highway relocated by the company would stay in place after project shutdown. On all other roads, the pavement, if any, would be hauled away. The road surface would then be ripped and recontoured. (Any roads approved for future use by the U.S. Forest Service would remain.)

Tailings pond reclamation would begin with the removal of water from both the pond and from the settled tailings. When the tailings are dry enough to support equipment, bulldozers would reshape the surface, removing the tailings dam crest and grading the entire surface into a mound with a minimum slope of 2 percent--a shape that would shed water (fig. II-9). If the surface subsides from tailings settlement, the low areas would be filled and regraded to prevent puddling of water. The company may cover the impoundment with waste rock to provide a stable surface for reclamation equipment to drive on.

Soil would be spread on all disturbed areas, including the tailings pond, mill site, shaft site, and portal sites. The only exceptions, if approved by the Department of State Lands and U.S. Forest Service, would be portal sites that lie on bare, rocky slopes. The tailings pond would be covered with about 2 to 2.5 feet of soil.

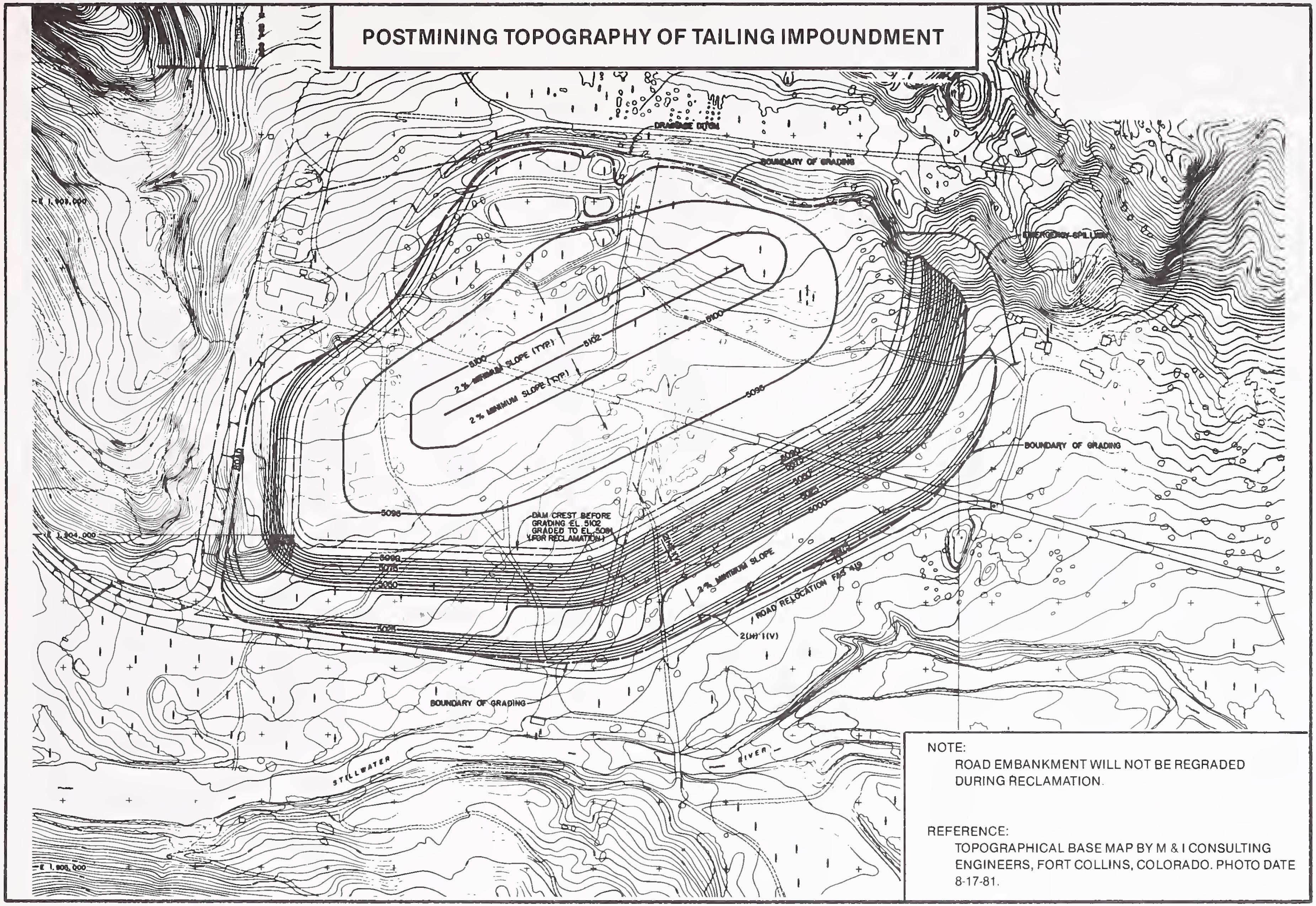
Wherever possible, the company would roll all surfaces with a land imprinter, a steel drum with geometric protrusions that press the soil into a varied pattern of depressions and ridges. The imprinting would help reduce erosion and improve infiltration. The company would plant the surface in early spring (April, May) or late fall (October), primarily with grass seed and tree and shrub seedlings. The company would use one seed mixture for the high elevations and another for the low elevations. Five hundred containerized seedlings per acre would be planted to benefit wildlife and to match nearby plant communities. The woody species planted would come from one of five mixtures, which would vary with the elevation and aspect of the planting site.

To further control erosion, all areas with slopes under 50 percent would be mulched with straw crimped into the soil. On steeper slopes soil-mulch tackifier, hydromulching, or, possibly, netting would be used. The soil would also be fertilized, possibly with 100 pounds per acre of 10-16-0 fertilizer.

The purpose of reclamation would be to reestablish the premining land uses: recreation and wildlife habitat.

Monitoring

Throughout the life of the project, the company would monitor the quality of surface and ground water. Samples of Stillwater River water would be taken and analyzed quarterly from sites both above and below the project. Ground


POSTMINING TOPOGRAPHY OF TAILING IMPOUNDMENT

NOTE:
ROAD EMBANKMENT WILL NOT BE REGRADED DURING RECLAMATION.

REFERENCE:
TOPOGRAPHICAL BASE MAP BY M & I CONSULTING ENGINEERS, FORT COLLINS, COLORADO. PHOTO DATE 8-17-81.

FIGURE II-9

After mining, the company would grade the tailings impoundment into a gently sloping dome. The dam crest would be removed. The company would also remove all milling buildings and support facilities.

water samples would be taken from four wells on the east side of the tailings impoundment, between the highway and the Stillwater River. The company would also monitor the amount and quality of water leaving the underground mine workings. Water quality monitoring would continue after project shutdown and would last as long as the Department of State Lands and U.S. Forest Service consider the monitoring necessary. Should any water quality problems develop, Stillwater Mining Company would be required to alleviate them.

The tailings dam would be inspected daily for slope stability. The company would also construct and periodically survey monuments placed at the crest of the tailings dam and would install piezometers to monitor ground water levels under the dam foundation.

After project shutdown, the company would monitor revegetation success. Monitoring would continue until the Department of State Lands deemed revegetation successful. The degree of success would be evaluated two years after revegetation by comparing reclaimed sites with nearby undisturbed native sites.

PRODUCTION SYSTEM ALTERNATIVES

Production System Alternative 1

This alternative differs from the proposal in that the tailings impoundment would be at the Stratton Ranch. The fine fraction of tailings (slimes) would be pumped to the tailings impoundment in a slurry pipeline about 2 miles long.

The mining methods and mill location would be the same as the proposal. The coarse-fraction tailings, as in the proposal, would be backfilled into the mine.

The pipe carrying the slurry would measure four inches in diameter. A 6-inch (low-pressure) pipe for returning water from the tailings pond to the mill would be placed alongside the slurry line. Both pipes would be buried. For the purposes of this analysis, it is assumed that the slurry line would run in the borrow pit of FAS 419. The line would require one pump station.

The tailings impoundment would be built in stages. The dam would be made of earth excavated from the site and the bottom would be covered with a hypalon liner. The tailings dam would be about 82 feet high, and the impoundment and dam would cover about 77 acres. At the end of mining the tailings dam would be about 600 feet from the Stillwater River. Because the sand plant used for backfilling the tailings can be expected to occasionally shut down, an emergency coarse-fraction tailings pond would be required at the minesite. The emergency pond would cover 10 acres. The emergency pond would be 6 feet deep and the dam 15 feet high. The pond would also be lined with an impervious liner. The pond would be designed so that coarse-fraction tailings could be recovered for backfill into the mine. Similarly, any fine fraction could be recovered and pumped to the permanent disposal pond.

Waste rock that would have gone into the tailings dam construction at the minesite under the company's proposal would be dumped on the surface. Approximately 1.13 million cubic yards of waste rock would be dumped outside of the mine. The dump would be about 50 feet high and would cover about 35 acres.

Reclamation in this alternative would restore disturbances to the same standard of stability and utility.

Production System Alternative 2

This alternative differs from the proposal and alternative 1 in that: the tailings impoundment would be built at Hertzler Valley. Impoundment design and construction would be similar to alternative 1, except that the impoundment would not require an impervious liner. The dam would be constructed of earthen material. The tailings impoundment and dam would be about 85-feet high, 129 acres in size, and approximately 1 1/2 miles from the Stillwater River.

The slurry pipeline and return water line would be 7 to 9 miles in length and would run in the borrow pit of FAS 419. As with alternative 1, both pipelines would be buried. Where the pipelines cross the West Fork of the Stillwater River, the pipelines will be sleeved in larger diameter pipes, each approximately 300-feet long, which would be strapped to the two bridges. Small catchment basins would be excavated on both sides of the bridges to retain possible leakage. One booster pump station would be required about 3.5 miles from the tailings impoundment. A small 100,000-gallon lined emergency impoundment would be built at the pump station for spill control.

Similar to alternative 1, an emergency tailings pond and a waste rock dump would be required at the minesite. The dimensions and acres disturbed for each would be the same as alternative 1.

COST ESTIMATES OF PRODUCTION SYSTEM ALTERNATIVES

The cost to build each alternative system depends on two kinds of costs: capital and operating. Capital costs result from facility construction, road building, equipment purchase, and underground development preceding ore production. Operating costs result from daily operation of the project: payroll, maintenance fees, electricity bills, periodic equipment replacement. Capital and operating costs must be combined to compare alternatives (table II-2).

The method used here to compare costs employs present value analysis, a technique that accounts for the value of an investment to change through time. Present values represent "discounted dollars," arrived at by calculations that take into account the fact that a dollar earned in the future is less valuable than a dollar earned today. For instance $1.00 invested at 15 percent is worth $1.15 in one year and $1.32 in two years. Discounting reverses this process; an outlay of $1.32 made two years from now and discounted at 15 percent is worth $1.00 now.

TABLE II-2

Present Value of Cost Estimates for
Tailings Disposal Alternatives
In Millions of 1983 Dollars*

Alternative	Low Range	High Range
(proposal)	$11.27	$16.75
1	15.58	18.09
2	15.15	18.58

*Total costs were discounted at 15 percent to arrive at present value.

Source: Stillwater Mining Company, 1984a, p. A-15; U.S. Bureau of Mines, 1985, pp. 14-21; Department of State Lands; Les Darling, Environmental Coordinator, Stillwater Mining Company, written com., July 25, 1985.

Cost estimates presented in table II-2 are accurate to within 25 to 40 percent. No higher level of accuracy is possible when costs must be estimated from only a rough (conceptual) project plan. Cost estimates are not generally refined until later stages of project development.

The difference in costs among alternatives results from variations in capital and operating expenditures, differences in tailings dam construction, slurry line construction, and related project requirements.

POWER SUPPLY ALTERNATIVES

Montana Power Company has considered three main transmission line alternatives. One alternative, converting the existing Laurel-Mystic-Laurel 50 kV to 69 kV was considered uneconomical. A second alternative, to build a new 100-kV transmission line from Bridger to the Stillwater area, was considered acceptable, but probably would not be sufficient to meet future load demands. Only the third alternative, construction of a 161-kV transmission line is proposed by Montana Power Company.

Montana Power Company's proposed 161-kV transmission line would be built from the existing Anaconda-Billings 161-kV line, 40 miles to the north, to a substation at Nye. The existing Benbow-Mouat 50-kV line would connect the substation to the mine. MPC proposes no upgrading of the 50-kV line.

The 161-kV power line would be suspended from 2-pole, wooden, H-frame structures 43 to 70 feet above the ground. The supporting structures would be about 800 feet apart and the line would be at least 25 feet above the ground. The standard right-of-way for a 161-kV line is 80 feet, but this may be reduced to 40 feet in some areas (cultivated land, for example).

Two potential sites for the substation have been chosen. One site is north of the Stillwater River (fig. I-3). With this option, a short section of less than one mile of twin 50-kV lines would be built from the substation across the Stillwater River to connect with the existing Benbow-Mouat 50-kV line. The second site is located south of the Stillwater River (fig. I-3) and would necessitate crossing the river with the 161-kV line.

Before a power line can be constructed, Montana Power Company must obtain a Certificate of Public Need and Environmental Compatibility. An application must be filed with both the Montana Department of Natural Resources and Conservation (DNRC) and the Montana Department of Health and Environmental Sciences. Both the Board of Natural Resources and Conservation and the Board of Health have the power to reject the application. Alternative power-line routes and their associated effects must be studied, especially by DNRC, as prescribed by the Montana Major Facilities Siting Act.

Montana Power Company is currently studying alternative power-line routes and substation locations. Twenty-two power-line routes are being considered within two corridors (fig. I-3). The two corridors are analyzed in this EIS as individual alternatives:

Power Corridor Alternative 1

The 161-kV transmission line would be constructed in a corridor from Big Timber to the Nye substation. Within this corridor, 20 power-line routes are being considered (fig. I-3). The cost of line construction is estimated to be about $3.9 million.

Power Corridor Alternative 2

The power-line corridor would extend from the existing Anaconda-Billings 161-kV line at Sheep Creek to the Nye substation. Two routes are being examined within this corridor (fig. I-3). The cost of line construction is estimated to be about $3.7 million.

On-site Generation Alternative 3

Rather than constructing a new power line, Stillwater Mining Company could generate electricity on site. Such a generation facility would probably be an oil-fired 7.4-megawatt turbine generator package. The capital cost is estimated at $4.8 million and the operating cost is estimated to be $0.08 per kilowatt hour, compared to the capital and operating costs of $4 million and $0.02 to $0.05 per kilowatt hour for a new transmission line (Stillwater Mining Company, 1984).

MINE PORTAL ALTERNATIVES

Stillwater Mining Company proposes to build one shaft and eleven portals to serve the underground mine workings (fig. II-2). Construction of the portals would require the company to build about 1.4 miles of new roadway on the east side of Mountain View Ridge and construct two miles of 13-kV power line to service the portals and shaft. Two alternatives to Stillwater Mining Company's proposal would reduce the amount of road construction and mountainside surface disturbance.

Mine Portal Alternative 1

In this alternative, the company would use only the shaft and the two existing portals: the Minneapolis portal (5,150 feet) and the 6,550-foot portal. To make up for the lost mountainside access, the company would bore a 14-foot-diameter vertical shaft inside the mine to serve all mine levels. Similar to the proposal, a 13-kV power line would be constructed to service the portals and shaft.

Except for the shaft, the underground operations would remain generally the same as in the proposal. However, the shaft would require that the company drive a new portal at the 6,550 level and improve the access road to that level. The shaft would also require an additional 2 years of development work since the entire shaft would have to be finished before work could begin at any level in the mine. The total development time for this alternative would be 6.5 years, compared to the 4.5 years for the proposal.

Mine Portal Alternative 2

In this alternative, the company would mine as proposed, but would eliminate three portals: the 5,950-, 6,150-, and 6,350-level portals. The company would have to either drive an internal 14-foot-diameter shaft, the same as in alternative 1, or excavate a ramp and drive a 7-foot-diameter shaft. A 13-kV power line, as in the proposal and alternative 1, would be constructed to service the portals and shaft.

The underground mine operation would remain generally the same as in the proposed operation. If a ramp were built, however, the company would have to use rubber-tired machinery in addition to tracked equipment. The development time for either the ramp or shaft variation of alternative 2 would be the same as for the proposal: 4.5 years.

CAPITAL COSTS OF MINE PORTAL ALTERNATIVES

Table II-3 presents the capital cost estimates for the different portal arrangements. The costs are in current dollars and are not discounted as are the costs in table II-2. These cost estimates are accurate to within ± 25 to 40 percent.

TABLE II-3

Comparison of Capital Costs for
Surface Disturbance Alternatives
In Millions of 1983 Dollars

Alternative	Low Range	High Range
Proposal	$3.6	$5.0
1	5.0	12.3
2 (ramp)	4.4	6.0
2 (shaft)	5.3	13.4

Source: Stillwater Mining Company, 1984a, p. 10; U.S. Bureau of Mines, 1985, p. 4.

ALTERNATIVE ROUTES TO THE WEST FORK OF THE STILLWATER RIVER

Stillwater Mining Company's Proposal

Under the proposal, FR 846 would continue to provide the public access to the West Fork of the Stillwater River (figs. I-2 and I-4). FR 846 would be relocated for one-half mile, starting from FAS 419. The relocation would place the road at the toe of the tailings pond dam and along Mountain View Creek. The relocation would direct traffic around the west side of the mine buildings, where the road would connect with the existing FR 846. Gates would be constructed on FR 846 in three locations to keep the public from entering the mine complex.

West Fork Road Alternative

An alternative access road to the West Fork of the Stillwater could be built by reconstructing a one-mile abandoned road between the Picket Pin Road and FR 846 west of Horseman Flats (fig. I-4). A single-lane bridge would have to be constructed over the West Fork of the Stillwater River to connect FR 846 with the reconstructed road. Some private land would have to be purchased for the right-of-way. Approximately 2 miles of FR 846, starting where it leaves FAS 419, would be closed to the public and used exclusively by Stillwater Mining Company. Another mile would be closed to all traffic and rehabilitated. Although FR 846 from FAS 419 to the company's mountainside portals would be closed to the public, the Forest Service would retain its right-of-way.

The cost for this alternative would amount to approximately $150,000: Right-of-way acquisition is estimated at $10,000, bridge construction at $100,000, and road construction at $40,000. The company would pay all these costs. If the bridge were to be constructed to double-lane standards, the total cost would increase to $200,000. The bridge and road would be built to

Forest Service standards. The company would be required to reclaim the section of FR 846 from the turnoff for the upper portals to the east end of Horseman Flats.

NO-ACTION ALTERNATIVE

Under this alternative, the applicant would not develop the Stillwater Mine Project. Conditions described in Chapter I, No Action Alternative, and in III, Existing Environment would continue unchanged. SMC could continue exploration activity or close down the exploration activity and rehabilitate the surface disturbance.

DESCRIPTION OF AFFECTED ENVIRONMENT

An analysis of Stillwater Mining Company's proposal requires that the EIS cover 19 topics, representing the "environment" of the Stillwater Project today. This environment encompasses the resources, enterprises, services, facilities, and people that could be affected by the company's new mine.

The selection of EIS topics was guided by public and government agency concerns. Analysts from the Department of State Lands and the U.S. Forest Service compiled the issues they felt were important. The public added its concerns through letters and a public meeting (see Introduction).

The topics analyzed generally include information on only those parts of the environment that could be affected, directly or indirectly, by the project. For the sake of brevity, the parts of the environment that are not expected to be affected have not been discussed.

Note that the chapter not only describes the condition of the social, economic and natural environment today, but also the condition this environment would be in if the Stillwater Project never opened. This means the chapter does contain projections of the future--but a future without the mine. Chapter IV goes on to predict the future with the project.

GEOLOGY

General Geology--Stillwater Complex

The platinum-group metals that Stillwater Mining Company is considering mining are part of the Stillwater Complex (fig. III-1). The complex is 1 to 5 miles wide and 28 miles long, crossing the Boulder and Stillwater River valleys. The complex originated as a molten magma intrusion. The original intrusion contained iron, nickel, copper and platinum-group metals which settled out at different levels as the molten mass crystalized deep within the earth. Mountain building forces that created the Rocky Mountains brought a large block of this intrusion (the Stillwater Complex) to the surface. This type of deep intrusion exposed at the surface of the earth is rare. Because of its unusual geologic character and because of the metals associated with it, the Stillwater Complex has been investigated by numerous researchers (Howland et al., 1936; Wimmler 1948; Jones et al., 1960; Jackson, 1968; Page, 1977; Raedeke, 1979; Conn, 1979).

Platinum-group metals occur in several layers of the Stillwater Complex. The layer of highest concentration is only 3 to 15 feet wide. This narrow zone is nearly continuous and appears to extend the entire length of the complex (fig. III-1). Nickel-copper and chromite deposits are also present throughout the complex, but are less continuous, occurring as scattered, isolated pockets.

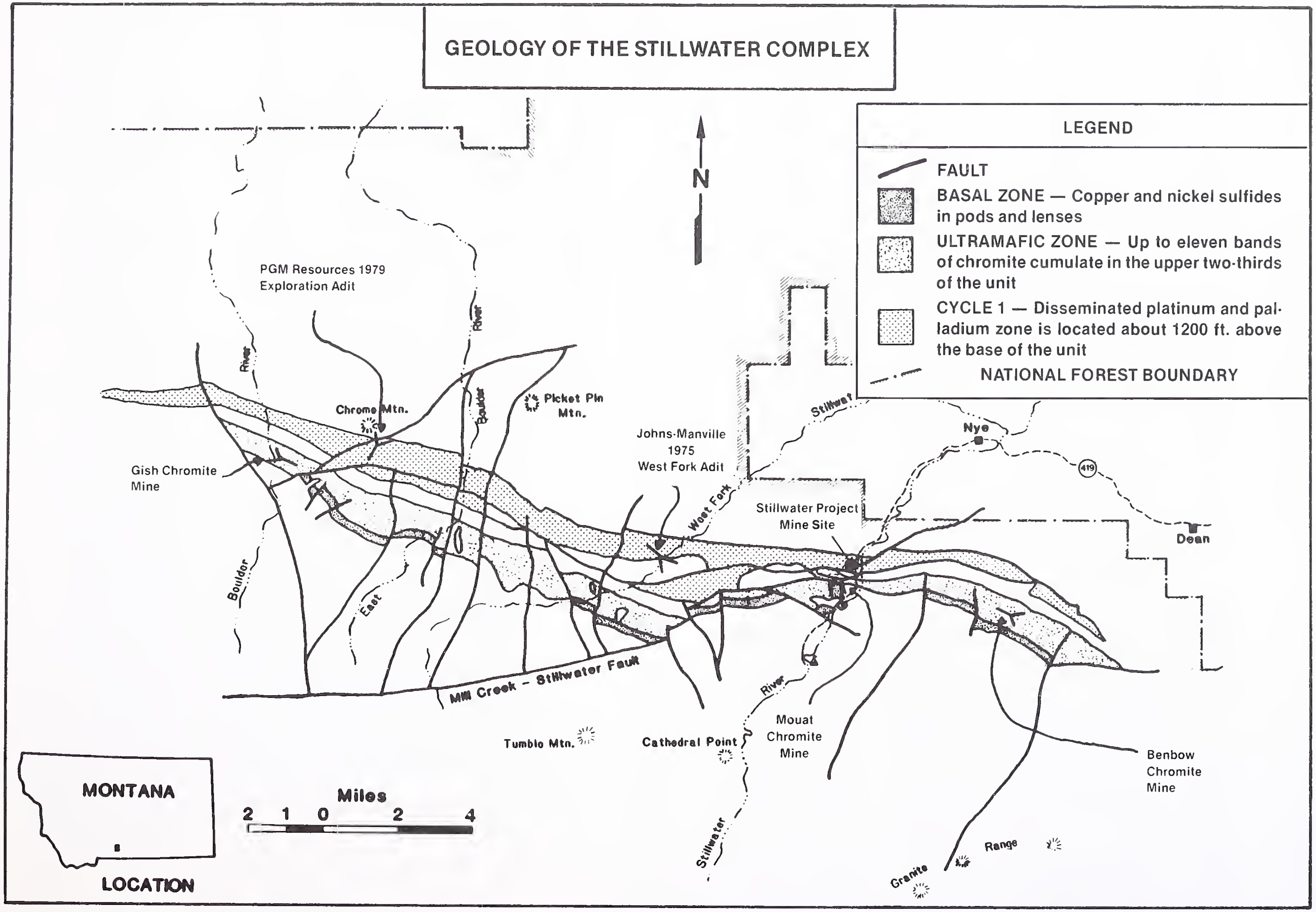

GEOLOGY OF THE STILLWATER COMPLEX
LEGEND
FAULT
BASAL ZONE — Copper and nickel sulfides in pods and lenses
ULTRAMAFIC ZONE — Up to eleven bands of chromite cumulate in the upper two-thirds of the unit
CYCLE 1 — Disseminated platinum and palladium zone is located about 1200 ft. above the base of the unit
NATIONAL FOREST BOUNDARY
N
PGM Resources 1979 Exploration Adit
Chrome Mtn.
Picket Pin Mtn.
Johns-Manville 1975 West Fork Adit
Gish Chromite Mine
Stillwater Project Mine Site
Nye
419
Dean
Boulder River
East Boulder
West Fork Stillwater
Mill Creek - Stillwater Fault
Tumble Mtn.
Cathedral Point
Mouat Chromite Mine
Stillwater River
Benbow Chromite Mine
Granite Range
MONTANA
LOCATION
Miles
2 1 0 2 4

FIGURE III-1

Although the Stillwater Complex is 1 to 5 miles wide, the zone of highest platinum mineralization reaches a maximum width of only 20 feet within the much broader cycle 1 unit. The complex contains an estimated 70 percent of U.S. platinum reserves. Other metals in the complex include chromite, copper, and nickel.

Historical Mining in the Stillwater Complex

Chromite

Interest in ore within the Stillwater Complex first developed during World War I, but it wasn't until World War II that ore was actually produced. In 1941 Anaconda Copper Company received a subsidized contract with the U.S. Government and began underground development at three separate sites along the Stillwater Complex: (1) the Benbow area; (2) the Mountain View area, 6 miles southwest of Nye; and (3) the Gish area (see fig. III-1). The Anaconda Company produced about 71,500 long tons of concentrate from the Benbow area, averaging about 42 percent chromite, and 26,000 tons of concentrate (averaging about 34 percent chromite) from the Mouat Mine. All operations stopped in 1943 because high-grade chromite was again available from overseas sources (Read, 1977).

From 1953 to 1961 the American Chrome Company, under another U.S. Government-subsidized contract, produced 900,000 tons of chromite concentrate from the Mouat Mine. Some of this was stockpiled near Stillwater Mining Company's present mine headquarters building for strategic purposes. In the early 1970s, the U.S. government sold the chromite stockpile to a private company, which has since removed all chromite from the site. A large stockpile of chromite still exists next to the railroad in Columbus.

An estimated 70 percent of domestic reserves of chromite ore remain in the Stillwater Complex. All of this ore is of the high-iron, low-chromium variety, only marginally suitable for stainless steel production. Further advances in chromium-ferro alloying could make these deposits economic (Read, 1977, p. 12).

Copper and Nickel

As early as 1936 the Stillwater Complex was recognized as a possible source of other metals besides chromite, including copper, nickel and platinum-group metals. As yet, none of these metals have been produced in commercial quantities. The Stillwater Complex contains what is believed to be the second largest nickel resource in the United States. Even so, the nickel and copper concentrate of the Stillwater deposits is not rich enough at current prices to justify nickel and copper development; higher grade ore is readily available elsewhere.

Three companies own the largest blocks of copper-nickel deposits within the complex. They are the Anaconda Minerals Company, AMAX, and Cyprus Mines. Individuals and the Monta Vista Corporation of Billings own smaller portions.

Platinum-group Metals

When the demand for and price of platinum-group metals drastically increased in the late 1960s and early 1970s, exploration for these metals began in the Stillwater Complex. Johns-Manville Sales Corporation, which initiated exploration work in the Stillwater Complex in 1967, identified four zones with high platinum-group metal values. One of these was found to be nearly continuous for about 24 miles of the 28-mile-long Stillwater Complex. As a result, the company filed claims on a large portion of the complex (fig. II-3).

Johns-Manville initiated underground exploration in the north wall (6,500-foot elevation) of the West Fork of the Stillwater River (fig. II-3). The average grade was 14.7 parts per million total precious metals, which compares favorably with total metal values now produced in the Merensky Reef/Bushveld complex of South Africa, the major world supplier of platinum-group metals. Nonetheless, Johns-Manville had to abandon this operation in 1976 because water under very high pressure was encountered in the adit.

In 1979, PGM Resources, a Johns-Manville/Chevron USA partnership, began development of a second exploration (Frog Pond) adit farther west in the Stillwater Complex. Exploration work and project engineering assessment for this project proceeded until 1983, when the Stillwater Mining Company was formed.

Anaconda has owned the mineral rights to the area around the old Mouat Chromite Mine since the 1940s. In 1977 Anaconda mapped its properties, identifying the same zone of platinum-palladium mineralization that Johns Manville had claimed over most of the complex. In mid-1979 the company began construction of the Minneapolis adit and by late December reached the mineralized zone. Exploration work has continued since (see chapter II). In 1983 Anaconda Minerals Company, Johns-Manville, and PGM Resources formed a joint-venture partnership--the Stillwater Mining Company--to develop the Stillwater project at Nye. Since then, Anaconda Mineral's sold its interest to LAC Minerals Ltd.

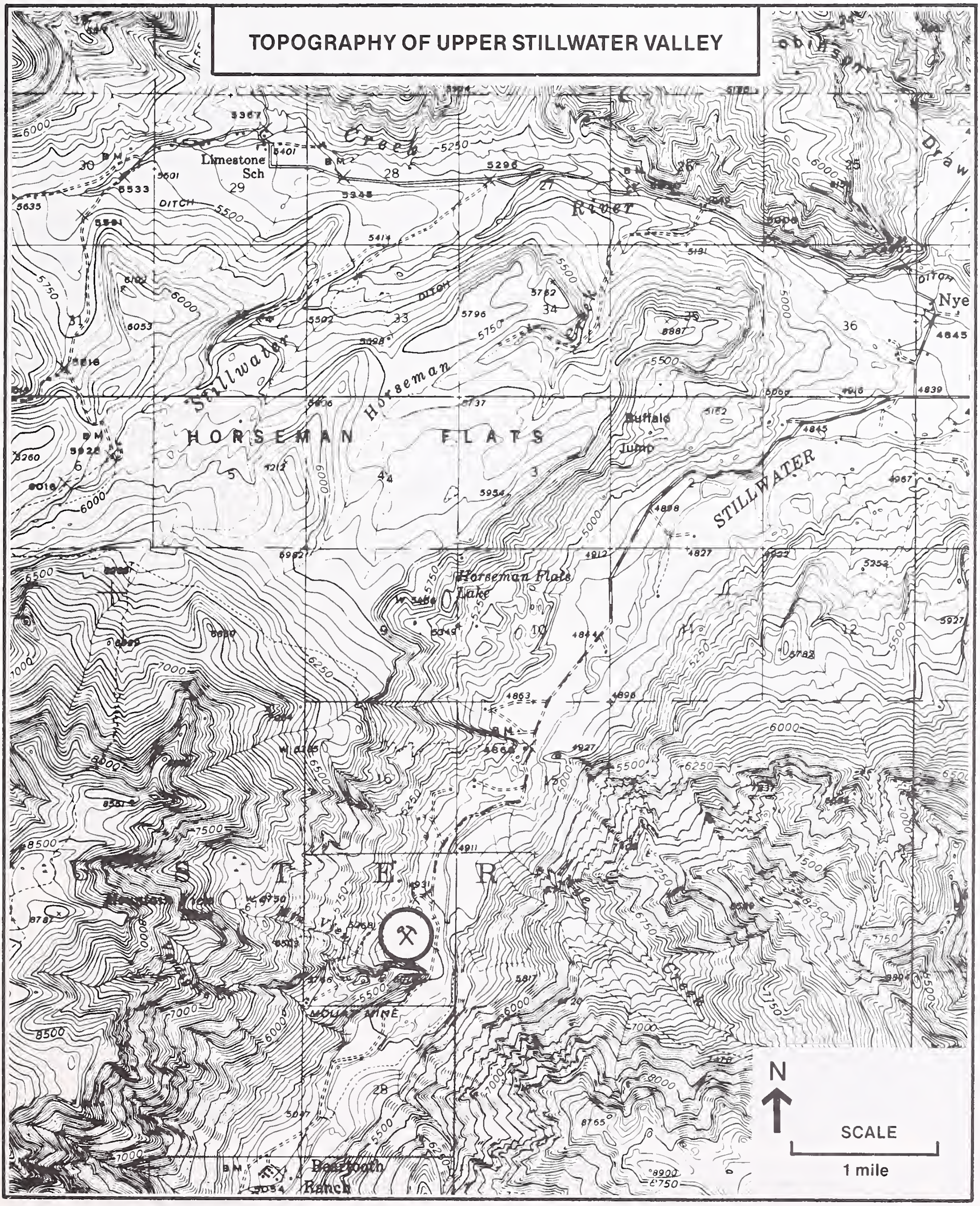
General Geology of the Minesite (Proposal)

Topography and Geomorphology

The existing exploration adit is located one-quarter mile west of the Stillwater River at the base of the steep side slope of the valley (fig. III-2). The topography climbs at less than a 10 percent grade from the river up to the adit, then quickly steepens to a grade averaging about 25 percent. Farther upslope, within one half mile of the river, the landscape again flattens, to less than 8 percent. Here, Mountain View Lake lies in a depression on landslide deposits on the side of the mountain. Several small streams near the mine flow from the steep mountainside, emptying into the Stillwater River. Mountain View Creek flows from Mountain View Lake, emptying into the Stillwater River along the southern boundary of the minesite (fig. III-2).

Surficial Geology

Three general types of unconsolidated deposits exist at the minesite: alluvium (stream-laid deposits), colluvium (gravity-controlled deposits) and ancient mass-movement deposits. Two large landslides cover much of the slope above the minesite and at one time probably extended across the entire valley.



TOPOGRAPHY OF UPPER STILLWATER VALLEY

FIGURE III-2

The project site rises steeply from the head of the Stillwater Valley to the top of Mountain View ridge. The only gentle topography lies in the valley bottom and around Mountain View Lake.

These large slope failures probably occurred over 10,000 years ago, during one of the several recent glacial periods in North America's geologic past. The thickest and lowest portion of the main landslide was subsequently removed by the Stillwater River. Alluvial and colluvial deposits, including an alluvial fan of Mountain View Creek, then covered much of the lower parts of the landslide. Landslide deposits are known to exist under the alluvium at the old hospital (mine headquarters) and percolation pond area because landslide debris was encountered in several drill holes and test pits dug at the site.

Bedrock Geology

The Stillwater Complex cuts across the Stillwater River Valley at nearly a right angle (fig. III-1). The complex extends two directions from the mine--roughly due east into Nye Basin and west for about 25 miles into the Boulder River Valley. Near the minesite, the rocks of the complex are exposed over a 1.5- to 2-mile-wide band. The layers of the complex dive steeply under the surface toward the north at about 50 to 80 degrees (measured down from a horizontal plane).

Structural Geology

The mineralized area around the company's proposed mine and mill facilities has several large faults that offset the bedrock units (fig. III-3). The east-west trending South Prairie Fault passes just north of the Minneapolis adit. This fault appears to have offset some of the platinum-group mineralized zone, slightly reducing the amount of ore reserves (Jim Harrower, Anaconda Minerals Company, oral com., February 1982). The fault is at least 5 miles long.

Another east-west trending fault, called the Lake Fault, passes through the proposed permit area. It appears to extend across the Stillwater River Valley into the Nye Basin. The length of this fault is unknown. The inferred Stillwater Valley Fault is not visible because river deposits cover it. Its presence is indicated by offset geologic units on opposite sides of the valley. The length and continuity of this fault are unknown.

Most of the major movement along faults near the minesite occurred during the mountain building processes that formed the Rocky Mountains from 145 to 69 million years ago.

Geologic Hazards

Geologic hazards are natural conditions that could lead to damage of property or danger to human safety.

Earthquakes. Based on earthquake locations documented over the last 30 years, the Stillwater River area appears to have low earthquake activity. Areas within 100 miles are earthquake prone and have caused moderate ground shaking within the valley. The Hebgen Lake-Yellowstone Park area is one of the most active earthquake areas in the Rocky Mountains. The 1959 Hebgen Lake

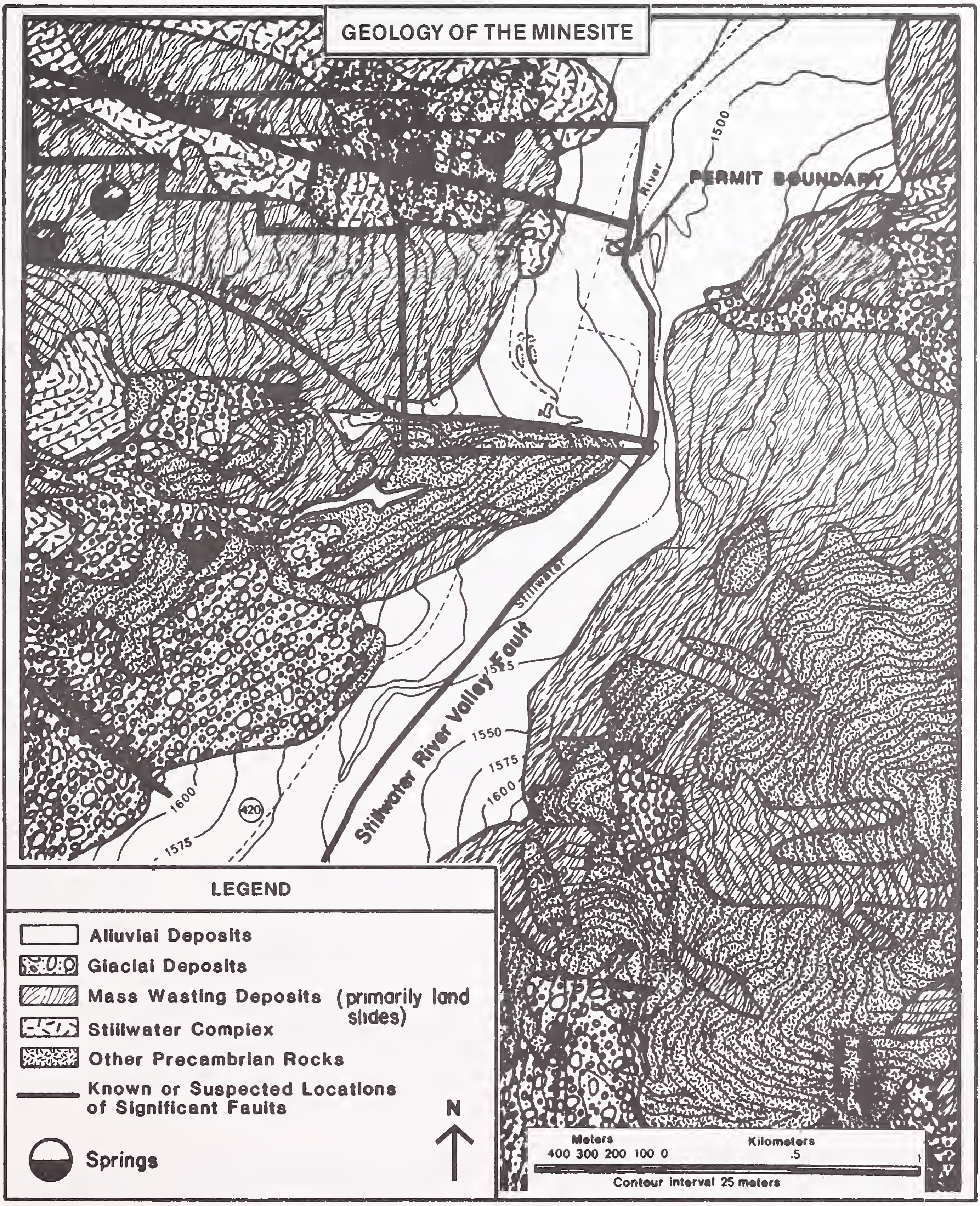


FIGURE III-3

Two large landslides cover the mountainside on which Stillwater Mining Company would bore new mine portals and build new access roads. The facilities and tailing impoundment would be constructed mostly on alluvial (stream-laid) deposits.

earthquake, measuring 7.1 on the Richter scale, caused ground shaking at Nye strong enough to break one water main, break dishes, crack foundations, and cause several rockfalls (modified Mercalli Intensity VI). This event is estimated to have produced peak ground accelerations of about 10 percent of gravity near Nye. The Hebgen Lake-Yellowstone Park area is the most likely area to cause ground shaking in the Stillwater River Valley in the future.

The nearest suspected active fault large enough to cause damage in the Stillwater Valley is the Emigrant Fault in the Yellowstone River Valley, about 32 miles west of the study area. The Emigrant Fault reportedly cuts recent (Pleistocene) surficial deposits, indicating that it is probably still active (Witkind, 1975). One recorded earthquake, measuring 4.2 magnitude (Richter scale), occurred in 1965 in the general vicinity of the Emigrant Fault (Camp Dresser and McKee, [CDM] 1981, p. 2.7-51). Although no concrete evidence is available, the offset in recent surficial deposits point to the Emigrant Fault as the probable source of the earthquake. The fault is capable of producing up to a maximum magnitude-7 earthquake because of its long length. A magnitude 7 earthquake, although very unlikely, could trigger large rockfalls or landslides, cause chimneys to break and fall, crack roads and bridges, and crack concrete foundations in the Stillwater River Valley. It could produce peak accelerations of about 17 percent of gravity in the Stillwater Valley.

Recent movement along local, small-scale faults has been reported next to the project area in the following locations: near Little Rocky Creek, on the south slope of Contact Mountain, and to the north of Chrome Mountain. These small faults would be capable of producing only minor earthquakes. One recorded earthquake, magnitude 4.0, occurred along the Beartooth front in 1965, indicating that the Beartooth Mountains are not totally inactive. The exact location of the quake is unknown. None of the larger faults within the area exhibit any evidence of recent movement (CDM, 1981).

Avalanches. There are numerous avalanche tracks on the steep slopes on both sides of the Stillwater River near SMC's permit area, but the site itself is not within an identified avalanche corridor.

Slope failures. Slope failures ranging in size from small slumps to large landslides are present throughout the Stillwater Valley. Most of the failures occurred during past ice age advances, which ended roughly 10,000 years ago. The landslides most often occurred in unconsolidated surficial deposits, including lateral moraines, but also developed in highly weathered bedrock. The wetness of the ice ages probably contributed to slope instability by saturating the surficial deposits. Slope steepening resulting from the cutting of a large glacier may also have contributed to the numerous slope failures. The glacier also provided lateral support for the moraines; after the ice melted, the support was removed and the moraine materials probably slid.

Earthquakes causing ground shaking and postglacial stream downcutting may also have triggered some of the slides. Most of these slides are now well drained and are probably stable; however, some of the slides do have small ponds, bogs, and springs within them. Because water acts to lubricate and buoy, decreasing particle cohesion, these saturated areas may be potentially unstable.

In June 1975, one small landslide occurred beside the West Fork of the Stillwater River near Johns Manville's exploration work on the West Fork adit (fig. III-2). This occurrence indicates that landslides in the region can happen when unstable material on steep slopes becomes saturated. In 1975 the snowpack was much deeper than usual in the month of June. Heavier than usual rainfall also occurred. The shale and glacial material became saturated and failed. Johns Manville's activities near the slide probably were not a factor in causing this landslide (D.C. MacIntyre, Forest Supervisor, Custer National Forest letter to Miles Keogh, Nye, Montana, September 16, 1977).

Two landslides exist within and upslope of the company's proposed mine/mill complex (fig. III-3). The boundaries of these landslides are probably somewhat larger than indicated on the map, especially downslope of the larger landslide. Landslide deposits associated with the largest landslide were encountered in drill holes and excavation work beneath Stillwater River terrace deposits near the existing percolation ponds. This old landslide extended well into the Stillwater Valley and may at one time have temporarily dammed the river (Robert Hinshaw and Larry Prinkki, U.S. Forest Service, Region I, Geotechnical and Field Investigation staff, written com. to Director of Engineering, December 15, 1981).

Despite considerable human activity (road construction, blasting, tunnel development) in and around these two landslides, they have not moved to any discernible degree. Even the strong ground shaking caused by the 1959 Hebgen Lake earthquake did not cause ground failures at the site. Even so, the largest landslide does have characteristics that are important to note: (1) much of the toe of the landslide has now been removed by the Stillwater River or by glaciers--the material resting upslope has therefore lost some support; (2) the landslide is more than 400 feet thick in its middle section; (3) SMC's adit development trend parallels the steepest, and probably the most unstable, part of the large landslide, and (4) several springs originate from the larger landslide, which also contains Mountain View Lake.

The existing upper support adit (6,550-foot level) is located within the edge of the larger landslide. The support tunnel was driven through 440 feet of landslide debris. The landslide material ranges from sand-size particles to boulders several feet in diameter. Anaconda Minerals Company had to use massive metal beams to support the upper support tunnel. Although construction methods included blasting, no movement has been identified in the landslide (Hinshaw and Prinkki, 1981).

Preliminary field investigations done by Forest Service personnel determined that these two landslides appear to be fairly stable and have low probability of failure (Hinshaw and Prinkki, 1981). Even so, because of the abovementioned conditions, the possibility of these materials failings again cannot be totally ruled out (see chapter IV, Geology, Geologic Hazards).

Besides the known landslides, many of the geologic units within the upper Stillwater Valley were mapped as potentially unstable slopes by the geologic consultant hired by Anaconda. These areas have characteristics similar to areas that have failed. Natural environmental variables (erosion, earthquakes, moisture increases, and weathering) along with changes induced by man are considered to be the most important factors influencing the stability of potentially unstable slopes and the existing landslides (see chapter IV, Geology, Geologic Hazards).

Geology of the Stratton Ranch Site (Alternative 1)

The Stratton Ranch site is similar in many respects to the minesite. Sedimentary bedrock lies along the southern and southwestern margins of the impoundment site. These strata have been upturned and now dip steeply to the north. Resistant Madison limestone forms a prominent ridge that extends about a third of the way across the Stillwater Valley along the southern edge of the site.

Unconsolidated deposits cover the majority of the site. These include Stillwater River terrace deposits, alluvial fan deposits of a small tributary creek, and landslide deposits. The Stillwater River terrace deposits are over 100 feet thick. Upwards of 60 feet of alluvial fan deposits interfinger with the Stillwater terrace deposits in the southwestern corner of the site. Landslide deposits exist along the north-northeastern margins of the site. The landslide deposit covers about a square mile and is over 53 feet thick. Prominent slump scarps exist at the upper edge of the landslide. The landslide probably occurred during or soon after the last glacial advance, roughly 10,000 years ago.

Geology of the Hertzler Valley Site (Alternative 2)

Anaconda Minerals Company originally proposed to locate the mill and tailings pond in a small north-facing tributary valley to the Hertzler Valley (now an alternative to Stillwater Mining Company's proposal). The Hertzler Valley is a tributary to the Stillwater River. The valley is just over 2 miles long and drops from 4,900 feet at its western end to 4,680 feet where it enters the Stillwater River. Bush mountain, elevation 5,300 feet, separates the Hertzler site from the Stillwater Valley.

The small tributary that would be filled with tailings at this site is about one mile long and drains to the north. The upper end of this tributary drainage starts at an elevation of 4,940 feet and drops to about 4,820 feet, where it enters the valley.

Surficial Geology

The entire Hertzler Valley is covered by coalesced alluvial fan deposits from side tributary drainages. These fan deposits vary in thickness depending on their proximity to the contributing tributary. The fan deposits cover older glacial outwash material. The outwash deposits are more than 80 feet thick in the middle of the valley.

The Hertzler site itself is entirely covered with glacial deposits. The deposits are composed of pebble- to boulder-size fragments up to 50 feet (average less than 5 feet) in diameter in a matrix of clayey, silty sand (CDM, 1981, p. 2.7-16). The thickness of the glacial deposits varies and is not well known.

Bedrock Geology

The Colorado and Montana group sedimentary rocks are the two uppermost sedimentary bedrock units underlying the Hertzler Valley. The Colorado group rocks, the deepest bedrock units identified in the valley, are composed mostly of shale with smaller horizons of interbedded sandstone. The total thickness of the Colorado group rocks is between 2,300 and 3,300 feet. The Montana group, overlying the Colorado group rocks, consists of a 100-foot-thick sandstone unit (Virgelle Sandstone) at the bottom. Above that are alternating layers of shale and fine-grained sandstone. Still higher in the sequence is fine-grained silty sandstone. The total thickness of Montana group is between 650 and 700 feet (CDM, 1981, p. 2.7-14). A thin coal seam also exits near the base of the undifferentiated Montana group rocks. The high percentage of shale rocks in the Colorado and Montana group rocks severely restricts ground water movement through them (see Hydrology, Ground Water).

Geologic Hazards

Most of the land under the Hertzler site is mantled with glacial outwash deposits. For the most part, this glacial material is stable, although there are some areas that have the potential to be unstable. The Bush Mountain area is probably capable of landslide or rockfall, as are very small acreages around Dead Horse Lake. The unconsolidated deposits in these areas are resting at steep angles. These potentially unstable slopes pose little hazards because they are of relatively limited extent.

The Hertzler Valley site is roughly 7 miles northeast of the minesite and is that much farther from known areas of frequent earthquake activity. The potential for severe earthquake ground shaking is therefore less than that of the minesite. The overall geologic hazard potential for the Hertzler Valley site is low.

HYDROLOGY

Surface Water

Stillwater River

Several surface water monitoring stations were established by Anaconda Minerals Company in June 1980. Some have been continuously maintained since then by Stillwater Mining Company. Flow and water quality measurements were collected on Verdigris Creek, Mountain View Creek, Nye Creek, West Fork Stillwater River, and on five sites along the Stillwater River.

The Stillwater River flows within one-quarter mile of the mine and Stratton Ranch sites, generally less than a mile from FAS 419, and within three-quarters of a mile of the Hertzler Valley tailings site (fig. I-1). All water that flows from the project area drains into the Stillwater River. Most other drainages within the southeastern portion of the Beartooth Mountains also flow into the Stillwater River.

Flows in the river usually peak during June or July from snowmelt and increased spring precipitation. Roughly three fourths of the annual runoff occurs in May, June, and July (Camp Dresser and McKee, [CDM] 1981, p. 2.2-4). At the U.S. Geological Survey's monitoring site near Nye, Montana, the maximum peak flow recorded was 6,400 cubic feet per second; the lowest flow recorded was 23 cubic feet per second, or less than 1 percent of the maximum flow. The upper Stillwater basin has a high average annual precipitation rate (20 to 40 inches per year) and rough topography (maximum relief is 6,400 feet), which account for the wide range in water flows and high spring runoff.

The 100-year and 500-year flood-prone areas for the Stillwater River Valley north of the Custer National Forest boundary were outlined by the Soil Conservation Service in 1979 (CDM, 1981, p. 2.7-36). CDM (Anaconda's hydrology baseline study consultant) outlined the potential floodplain of the Stillwater south of the Custer National Forest boundary using physical evidence of past flooding. Based upon these two studies, SMC's proposed tailings impoundment and the Stratton Ranch tailings site are totally outside the estimated 500-year floodplain of the Stillwater River.

Surface water quality within the Stillwater River Basin is generally good to excellent, reflecting the undeveloped state of the area (Mid-Yellowstone Areawide Planning Organization, 1978) and the general lack of geologic strata that are capable of creating poor water quality. The Stillwater River is classified as a B-1 type by the Montana Department of Health and Environmental Sciences, meaning the water is generally suitable after conventional water treatment for drinking, cooking, and food processing. The water may be used without further treatment for bathing; swimming; recreation; growth and propagation of trout fisheries and associated aquatic life, water fowl and furbearers; and agricultural and industrial supply.

Total dissolved solids (a rough measure of salinity) is typically very low, usually below 100 milligrams per liter (mg/l). Dissolved solids, alkalinity, and hardness increase gradually downstream within the Stillwater River, which is a typical occurrence in streams of the region. The water is generally soft, is low in dissolved solids (11-152 milligrams/liter), is between 6.3 to 9.9 in pH (7 pH is neutral), and has a calcium bicarbonate composition. The river has a low buffering capacity because its water has fairly low alkalinity (1980-81 one-year average for the upper Stillwater River was 60 mg/l). A large amount of acidic water, if introduced, would affect the pH of the river. The river also exhibits low hardness (one-year average of upper Stillwater River was 34 mg/l). Water low in hardness tends to increase the toxicity of metals to aquatic organisms (McKee and Wolf, 1974), although no detrimental adverse effects on aquatic life have been documented in the Stillwater River as a result of metals (see Aquatic Ecology).

Although water quality is excellent in most stretches of the Stillwater River, a number of locations have natural concentrations of cadmium, lead, and manganese that occasionally exceed drinking water standards set by the U.S. Environmental Protection Agency (ARM 16.20.6) and the Montana Department of Health and Environmental Sciences (1980). The standards, 0.01 mg/l for cadmium, 0.05 mg/l for lead, and 0.05 for manganese, were established for water sources used by humans on a continuous basis.

Iron levels in the Stillwater River and some of its tributaries occasionally are also above the criteria established by the EPA for domestic water supplies (American Fisheries Society, 1979, p. 121). Iron levels above the criteria level of 0.3 mg/l are not necessarily harmful--humans have a very high tolerance for iron. Rather, the levels were established for aesthetic purposes (taste and staining of laundry).

The slightly elevated levels of iron, lead, and manganese (total rather than dissolved) occur during periods of peak flow, when sediment transport is highest (Stillwater Mining Company, 1984a, p. 2.2-19). Thus, most of the metals are probably attached to the sediment.

Cadmium levels, by contrast, are highest during low-flow periods, indicating a majority of the cadmium is dissolved, rather than suspended in the water. Standard filtration processing of the water probably would not remove much of the cadmium. As a precaution, humans should not drink water from the river during low-flow periods. The elevated cadmium levels in stretches of the river may adversely affect sensitive species of aquatic life during low-flow periods.

Although the source of the elevated iron, lead, manganese, and cadmium levels has not been determined, they probably result from weathering and dissolution of bedrock in the upper Stillwater River Basin. For example, Verdigris Creek and the West Fork of the Stillwater River drain portions of the Stillwater Complex that contain sulfide and metal values above those normally found in the basin (CDM, 1981, p. 2.2-113). Accordingly, high average metal concentrations were found to be associated with channel sediments downstream of the confluence of these creeks and the Stillwater River.

Despite moderate increases in alluvial ground water nitrate and total nitrogen concentrations near the mine--a result of mine water seepage out of the existing percolation ponds (see chapter I)--concentrations in the river have largely been unaffected. Sampling stations both above and below the mine both had average nitrate concentrations of 0.09 mg/l for the five years the mine has been in development. The reason ground water quality has changed while the surface water quality has not lies in the fact that flow in the river is so much larger than either the percolation pond seepage or flow in the mine area ground water. The smallest amount of dilution of pond seepage by the time it reaches the river is 30 to 1 and normally is much greater.

Even under the most severe conditions--high flow and high nitrate concentrations in the pond seepage and low flow and high nitrate concentration in the river--excessive algal growth in the river would not occur. Based upon the ratio of total nitrogen to phosphorus in the river (greater than 10 to 1, Hydrometrics, 1984) growth of algae in the river is limited by the availability of phosphorus. Additional nitrogen compounds would have no influence.

Phosphorus in the mine discharge water is higher than in surrounding ground water, but is quickly bound in soil particles before reaching offsite waters. Monitoring wells in the alluvial ground water next to the percolation ponds show no increase in phosphorus. As such, the mine has had no influence on algae growth or the quality of Stillwater River aquatic life.

All other dissolved constituents in the mine water, such as metals, have remained well below levels which would be considered to be significant. Again, the dilution by the river of the small amount of mine water would obscure any small peak in mine water concentrations.

Tributaries to the Stillwater River

The tributary streams of the Stillwater River have variable water quality. The alpine and subalpine creeks of the upper half of the Stillwater River basin generally have low dissolved solid values and creeks of the lower half generally have higher dissolved solids. Water quality within the tributaries is generally poorest during low flow.

Water quality and quantity measurements were obtained for Verdigris Creek, Nye Creek, Mountain View Creek, and the West Fork of the Stillwater River (fig. III-2). Verdigris, Mountain View, and Nye creeks are alpine-subalpine tributaries to the Stillwater River and flow only during part of the year.

Verdigris Creek runoff water contains high levels of sulfate. This stems from the weathering of small pockets of sulfide minerals (pyrrhotite, pentlandite and chalcopyrite) in the bedrock of the middle portion of the Stillwater Complex across which this creek flows. These pockets produce sulfate complexes and slightly acidic water upon weathering. In Verdigris Creek, the sulfates become especially concentrated during low flow (late summer and winter). Cadmium and iron levels also occasionally exceed criteria for drinking or domestic water supplies. The diversity of aquatic invertebrates within Verdigris Creek was less than other nearby creeks, indicating that metals within the water probably adversely affect aquatic life (see Aquatic Ecology).

Verdigris Creek cuts across a large ancient landslide, and during high spring runoff the stream water picks up tremendous amounts of sediment. The channel is constantly cutting into the landslide material, causing large blocks of material to fall into the creek (Jim Harrower, Anaconda Minerals Company, pers. com., April 22, 1982). For its size, this creek contributes a large proportion of suspended and bedload sediment, including total metal load, to the Stillwater River.

Nye Creek, on the southeast side of the Stillwater River Valley, directly across from the proposed mine, drains an area of about 4 square miles. Chromium, iron, and manganese levels have been measured at concentrations well above these suggested by the EPA (1980) for drinking and domestic water supplies (0.05 mg/l for chromium, 0.30 mg/l for iron, and 0.05 mg/l for manganese). The diversity of aquatic invertebrates within Nye Creek is also low and may indicate adverse effects of metals on the aquatic community (see Aquatic Ecology). The Stillwater Complex, as it cuts across the Stillwater Valley, occupies a large percentage of the Nye Basin. This probably accounts for the elevated sulfates and metals in Nye Creek. Nye Creek also cuts through an area where old tailings from the chromite mines was deposited (on the terraces of the Stillwater River). Wind-blown tailings are a major source of suspended sediment in the creek (Phil Jaquith, Custer National Forest, District Ranger, oral com., April 15, 1982).

Mountain View Creek flows along the southern boundary of the SMC's proposed tailings impoundment. It originates from Mountain View Lake and flows almost due east toward the Stillwater River. The topography between the lake and the river is steep. The creek has relatively low peak flows, owing to its small drainage area.

Water within Mountain View Creek was sampled for water quality on two occasions. The measured parameters did not exceed drinking water standards established by EPA, however, chromium levels may be high enough to slightly reduce productivity of sensitive species of aquatic life (CDM, 1980).

Anaconda Minerals Company tapped the overflows from Mountain View Lake in 1980 to supply water to the upper support adit for drilling. Roughly 25 gallons per minute of water were drawn out from the lake for periods of about 6 hours a day (Hydrometrics, 1981). This withdrawal has had no discernible effects on the lake or the creek.

In places, the West Fork of the Stillwater River has cadmium and iron levels slightly above EPA criteria for drinking and domestic water supplies. The same Stillwater complex rocks containing pyrite underlie portions of the West Fork Basin and probably cause the reduced water quality. Overall, the presence of aquatic invertebrates that are sensitive to environmental degradation indicates that the West Fork of the Stillwater River generally has good quality water.

Minesite (Proposal)

Most of the minesite is drained by very small ephemeral drainages that flow directly into the Stillwater River. No attempt was made to sample water from these drainages. Mountain View Creek flows along the southern edge of the proposed tailings impoundment (see Tributary discussion above).

Stillwater Mining Company's underground workings have produced between 30 and 350 gallons per minute of water. During active mining, the Minneapolis Adit has produced an average of about 150 gallons per minute, peaking at 350 gpm. During mine shutdown from early 1982 to October 1983, the mine discharge dropped gradually to about 30 to 40 gpm. This water is temporarily retained in a series of percolation ponds before it enters the ground water system of the Stillwater River (see Ground Water). To date, no surface water discharge from these ponds has occurred. The percolation ponds are sufficiently large that no surface water discharge is expected (see chapter II).

To date, the quality of water coming out of the Minneapolis adit has been good. No adverse impacts on the surface waters of the area have occurred from Anaconda's or Stillwater Mining Company's exploration activities. Even so, mining has increased ammonia, nitrate, and phosphorus concentrations of the mine adit discharge. Nitrate and ammonia concentrations during active mining have averaged more than ten times higher than undisturbed bedrock ground water concentrations (see Ground Water, table III-1). Phosphorus concentrations are roughly three times nonmining concentrations. Incomplete combustion of ammonia nitrate fuel oil explosives is the major cause of these increases in mine adit discharge water during active mining. The mine water is sent to percolation ponds, where it becomes part of the alluvial ground water system.

Stratton Ranch Site (Alternative 1)

The Stratton Ranch site is located primarily on the uppermost terrace of the Stillwater River, well above the 500-year flood plain. A small perennial creek flows due east off the uplands above the site and disappears into alluvial fan deposits before reaching the actual impoundment site. The alluvial fan material exists where the steep perennial stream channel meets the relatively flat terrace of the Stillwater River. The coarser-grained alluvium was deposited in this fan, allowing the creek to seep into the ground water system.

The creek does flow all year round above the alluvial fan and potential tailings pond site, but flow records are unavailable. Water quality data are also unavailable for this creek.

Several perennial ponds exist near the site. Four are within one half mile of the site. Three of the ponds are located in the hummocky terrain of an old landslide flanking the site on the northwest. Another pond exists in the middle of the potential tailings impoundment. It is a manmade (bermed) pond with water levels maintained by inflow from the perennial creek. No water quality data are available on these ponds, although they all are believed to be of good quality; fish and other aquatic life were observed in the pond located within the impoundment site, indicating relatively good quality water.

Hertzler Valley Site (Alternative 2)

Two small, poorly developed coulees with no distinct drainage channels drain the Hertzler site. Both drainages start at the base of Bush Mountain and end in Hertzler Valley. The two drainages rarely, if ever, carry runoff. Rainfall and snowmelt falling on the site infiltrate into the glacial material, to be consumed by vegetation or become part of the ground water system.

No surface runoff occurred in the two small drainages occupying the Hertzler Valley site during a one-year sampling period (July 1980 to July 1981). As such, water quality analyses are not available.

An unnamed drainage flows down the center of the Hertzler Valley and has a small, indistinct drainage channel. An irrigation ditch that brings water from the West Fork of the Stillwater River does fill the channel (near the Hertzler homestead) during the irrigation season, but the channel is normally dry.

Runoff flowing into the Hertzler Valley from the north (Robinson Draw, Stanley Coulee, and Tandy Coal Mine Draw) appears to flow into the irrigation ditch, rather than reaching the main Hertzler valley. All three drainages are ephemeral, meaning they flow only in response to rapid snowmelt or intense rainstorm events. Runoff within these drainages occasionally contains constituent levels--cadmium and iron most often--above standards set for drinking water. Fecal coliform and sulfate values were also found to occasionally exceed recommended drinking water criteria (Environmental Protection Agency, 1981, and Montana Department of Health and Environmental Sciences, 1980). The bedrock (Eagle Formation) underneath these drainages contains sulfide metal complexes that slightly acidify runoff waters and probably are the reason for the elevated cadmium and iron values. Even though these waters are unsuitable for human consumption, they are of good enough quality for irrigating and stockwatering, their primary use.

Ground Water

Minesite (Proposal)

At the minesite two distinct groups of geologic units contain ground water: bedrock units and unconsolidated surficial deposits.

Bedrock Aquifer. Bedrock lies on both sides of the Stillwater River and beneath the surficial deposits that occupy the valley (fig. III-3). Ground water in the bedrock is mainly confined to openings such as joints, faults, and shear zones. The amount of ground water that could be extracted is difficult to predict and is highly variable (Stillwater Mining Company, 1984a, p. 2.4-7). The natural variability in geologic and hydrologic conditions makes it impossible to accurately predict ground water flow. (Stillwater Mining Company, 1984a, p. 2.4-17). For this reason bedrock in the upper Stillwater Valley Basin would not be a good unit to drill into for the sole purpose of obtaining water.

Large influxes of ground water into the main adit were not encountered during underground excavation, with the exception of one area. In that area, significant flows (170 gpm) were found in faults and shears that paralleled the banding of the Stillwater Complex rocks. Flows estimated at the working face of the adit ranged from less than 1 gallon per minute (gpm) to over 100 gpm. The total discharge of the adit peaked in June of 1980 at 385 gpm, but has decreased to as low as 30 gpm. All flows from fractures and drill holes have typically decreased with time to low, constant discharge rates.

Recharge of the bedrock ground water system probably occurs mostly at higher elevations, where snowmelt and rain infiltrate and percolate along joints, fractures, and bedrock discontinuities. Some recharge to the bedrock may occur via infiltration of ground water from saturated alluvial or other unconsolidated deposits located along the flanks of the Stillwater River.

Ground water leaves the bedrock as (1) surface springs and (2) discharge to unconsolidated subsurface materials low in the valleys and draws of the region. Fourteen springs have been identified between the mine and Hertzler Valley. Nine of these have been developed for domestic or livestock water supply (CDM, p. 2.3-23).

Ground water discharge from bedrock most likely contributes significantly to alluvial ground water and possibly surface water systems of the Stillwater River. Bedrock discharge, along with infiltrated surface runoff from snowmelt, contributes to the perennial character of the Stillwater River (Stillwater Mining Company, 1984a, p. 2.4-9).

Stillwater Mining Company's exploration adit has modified the flow pattern of ground water immediately around the excavations. Prior to the exploration work, ground water intercepted by the underground working flowed toward the Stillwater River Valley. Now it flows into the underground excavations and is directed to percolation ponds, where it seeps into the alluvium of the Stillwater River.

The dewatering of bedrock around the Minneapolis adit may have reduced the flow of a spring that was used as the sole water supply to the Hjelvik residence located 500 feet downslope of the Minneapolis adit. Anaconda replaced the depleted Hjelvik spring with a Stillwater River alluvium well. Adverse effects of continued development on other springs in the area have not been documented.

Ground water is generally of drinking-water quality in the bedrock immediately surrounding the platinum-group mineralized zone. Sulfide and metal values are low in this zone, leading to the relatively good quality of water (see Geology). In contrast, bedrock within the Stillwater Complex farther away from the platinum-group metals contains considerably higher amounts of sulfides; therefore, ground water passing through these areas is expected to have higher metal values than most of the ground water in the upper Stillwater River basin. Indirect evidence of poorer quality water in bedrock surrounding the platinum zone comes from three wells (fig. III-4) drilled in the Stillwater River alluvium immediately downgradient of the existing percolation ponds. Bedrock containing relatively high amounts of pyrite probably contributes to the poor quality of water in Verdigris and Nye creeks and the West Fork of the Stillwater River.

Unconsolidated Deposit Aquifers of the Minesite. The alluvium along the Stillwater River is the major source of ground water in the valley (see fig. III-5 for conceptual view of the valley alluvium). The general flow direction for the Stillwater River alluvial ground water is downstream, or from the south and west to the north and east. The Stillwater alluvium is

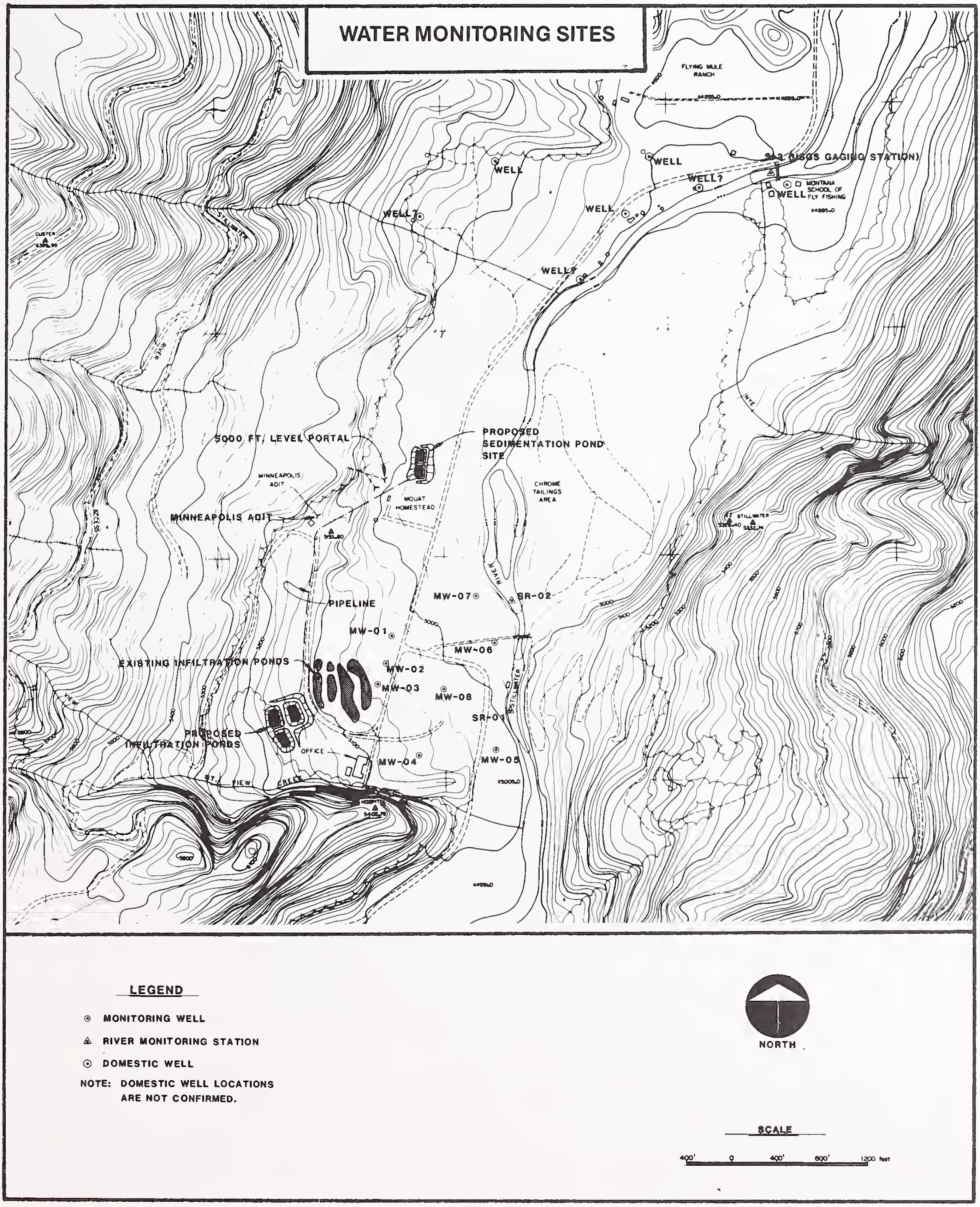


FIGURE III-4

Stillwater Mining Company drilled a number of wells within and below the project site to characterize ground water quality. The company also took monthly surface water samples at several stations along the Stillwater River. (See fig. III-8.)

capable of producing more than several hundred gallons a minute on a sustained basis. At least 17 wells are known to produce water from the alluvial deposits in the upper Stillwater River Valley. Fifteen of these are used as domestic water supplies.

Other surficial deposits of mass-wasting and glacial origin are present throughout the project area. These consist of talus, landslide deposits, glacial deposits, and other forms of loose, heterogeneous and unconsolidated material deposited chiefly by mass wasting.

The landslide deposits are variably saturated because of their jumbled physical and textural properties. Numerous springs found in the Beartooth Mountains are associated with landslide deposits. Several springs issue from the large landslide located just north of the Minneapolis adit (fig. III-3). Within the Stillwater River Valley, one spring associated with a landslide has been developed for domestic use and several others are used by livestock and wildlife.

Ground-water wells in the unconsolidated deposits of the Stillwater Valley upstream of the minesite are located at the Beartooth Ranch and the Woodbine Campground. The ground water in these wells is of very good quality with measured values well below the limits set for drinking water. The Stillwater River Valley alluvial deposits generally have very good quality water, although localized areas within the alluvium, such as the minesite and old chromite tailings disposal site, do have metal concentrations that exceed drinking water standards. The location of all such areas are not known.

In late 1979 Anaconda drilled three observation wells (MW01, MW02, and MW03) immediately downgradient of the percolation ponds used to treat the Minneapolis adit discharge water. All three were completed in Stillwater River alluvium. In the fall of 1983, Stillwater Mining Company drilled five additional alluvial monitoring and exploration wells (MW04, MW05, MW06, MW07, and MW08) in the proposed tailings impoundment site (fig. III-4). All eight wells were used to characterize the alluvial aquifer geometry, hydraulic properties, flow conditions and ground water quality of the tailings impoundment site. The wells indicate the alluvial aquifer varies from approximately 50 to 250 feet thick and averages about 100 feet under the minesite. In general, ground water flow in the alluvium near the mine is primarily to the north, approximately parallel to the river. Ground water flow immediately under the minesite is modified by the rather deep bedrock basin. Ground water enters the basin from the southeast around a bedrock ridge, spreads out under the impoundment site, then exits the basin to the northeast. Ground water nearer the river follows the northerly flow of the Stillwater River. Recharge to the alluvial aquifer principally comes from the Stillwater River, although some ground water enters the alluvial ground water from the bedrock. During low river flow, alluvial ground water appears to discharge to the Stillwater River along the northeastern margins of the minesite basin.

The amount of ground water passing through the alluvium immediately under the tailings impoundment site is difficult to accurately predict. The alluvium-filled basin has a complex shape and the saturated thickness and hydraulic conductivity values of the alluvial material vary. The alluvial flow rate could range from as little as 1,000 gpm to as high as 2,000 gpm, with the most probably flow rates being about 1,500 gpm.

Coarse-grained alluvial gravel (hydraulic conductivity of 200-400 feet/day) at depth account for the rather high flow rate through the Stillwater River valley deposits. Relatively low-permeability alluvial material (hydraulic conductivity of 5 feet/day) overlies the coarse-grained deposits, creating a semi-confined (artesian) alluvial aquifer at depth. Depth to ground water under the minesite ranges from 40 to 90 feet.

The monitoring wells indicate that the alluvial ground water quality is better close to the river. Ground water samples from the three wells closest to the river were below drinking water standard values, but water in the three wells (MW01, MW02, and MW03) near the percolation ponds exceeded drinking water criteria for one or more of the following constituents: total dissolved solids (TDS), chromium, iron, and selenium. Natural seepage of ground water through mineralized bedrock is believed to be the major source of elevated metal values. Seepage out of the Minneapolis adit percolation pond may also contribute slightly to the elevated levels in the three wells. (Evaporation of pond water could increase dissolved metal concentrations in the ground water.)

None of the wells located closer to the river contains water exceeding drinking water standards. These wells are considered to be representative of premining conditions.

The three monitoring wells closest to the percolation ponds also had higher ammonia and nitrate concentrations than monitoring wells closer to the river (table III-1). Ammonia concentrations in wells nearest the ponds, though low, are two to three times background levels. Ammonia concentrations are much higher in the adit water than in ground water, but much of the ammonia is converted in the ponds to nitrate by bacteria before reaching the ground water. As such, the ammonia in the mine water indirectly adds to the nitrate loading of the ground water.

The mine discharge water also contains fairly high amounts of nitrates, which add to the nutrient loading of the underlying ground water. Nitrate concentrations are as much as 10 times greater in the ground water near the percolation ponds (MW01, MW02, and MW03) than in ground water adjacent to the streams (MW04, MW07, and MW08). (See table III-1.)

Dilution of pond seepage water in the alluvial ground water downstream of the mine is believed to render all but nitrates undetectable from baseline conditions. Nitrate concentrations in monitoring wells closest to the ponds have remained below 3 mg/l, averaging about 1 mg/l, well below the drinking water standard of 10 mg/l. Alluvial ground water farther downstream probably contains less than 3.0 mg/l of nitrates due to mixing of the pond's nitrate plume in the alluvial ground water. For comparison, background nitrate concentrations have averaged about 0.1 mg/l (wells MW06, MW07, and MW08). The elevated nitrate concentration would not preclude the use of the ground water for drinking water or other purposes.

TABLE III-1

Ammonia, Nitrate, and Phosphorus Concentrations (mg/l) in Ground Water

	During Active Mining (1980-1981)		Shutdown (1982-Oct. 1983)	
	Mean	Range	Mean	Range
Minneapolis Adit Discharge				
Ammonia (NH_4-N)	0.76	0.02-3.57	0.11	0.02-3.57
Nitrate (NO_3-N)	1.7	0.11-5.23	0.07	0.02-0.18
Phosphorus (Total)	0.06	0.01-0.53	0.02	0.01-0.5
MW01 (Well)				
Ammonia (NH_4-N)	0.06	<0.01-0.16	0.09	0.01-0.20
Nitrate (NO_3-N)	0.49	0.01-0.73	0.56*	0.01-0.92
Phosphorus (Total)	0.04	<0.01-0.08	0.02	0.01-0.08
MW02 (Well)				
Ammonia (NH_4-N)	0.12	0.01-0.26	0.09	0.01-0.20
Nitrate (NO_3-N)	2.09	1.40-2.84	2.40*	1.47-2.24
Phosphorus (Total)	0.05	0.01-0.48	0.02	0.01-0.05
MW03 (Well)				
Ammonia (NH_4-N)	0.07	0.01-0.19	0.09,	0.11-0.26
Nitrate (NO_3-N)	0.38	0.29-0.54	0.32*	0.16-0.40
Phosphorus (Total)	0.04	0.01-0.15	0.02	0.01-0.04
MW06 (Well)				
Ammonia (NH_4-N)			0.03	0.01-0.12
Nitrate (NO_3-N)			0.17*	0.07-0.28
Phosphorus (Total)			0.03	0.01-0.05
MW07 (Well)				
Ammonia (NH_4-N)			0.03	0.01-0.13
Nitrate (NO_3-N)			0.06	0.02-0.12
Phosphorus (Total)			0.01	0.01-0.05
MW08 (Well)				
Ammonia (NH_4-N)			0.03	0.01-0.12
Nitrate (NO_3-N)			0.07	0.01-0.30
Phosphorus (Total)			0.01	0.01-0.05

*Monitoring wells were still influenced by percolation pond water despite temporary mine shutdown.

During low flow some of the alluvial ground water containing the percolation pond water entered the Stillwater River. However, dilution in the river appears to have masked any changes due to the mine; the river water would generally dilute pond seepage by a factor of over 100 to 1. Nitrate and ammonia concentrations have remained low both above and below the mine.

Total phosphorus concentrations are also elevated in the adit discharge water but approach background concentrations before reaching nearby monitoring wells. Phosphorus is evidently bound to sediment trapped in the percolation ponds.

Three additional observation wells were installed across the river from the mine. The wells were completed in the alluvial deposits upon which chromite mill tailings were deposited in the 1950s. Water samples collected from the alluvium beneath the tailings exceeded the drinking water limits for iron, lead, manganese, cadmium, and chromium. The old chromite tailings may contribute metals to the alluvial ground water system, as might the natural seepage of mineralized bedrock ground water. (Nye Basin, located upgradient and to the east of this tailings area, contains some Stillwater Complex rocks with high concentrations of sulfides and metals.) The relative contributions from tailings and from natural bedrock were not determined.

Stratton Ranch (Alternative 1)

The Stratton Ranch site is similar to the minesite in many respects. The site is located on a wide terrace of the Stillwater River that is confined by a prominent bedrock ridge on the south and by unconsolidated moderately-sloped deposits on the east. A large percentage of the ground water flowing under the impoundment site is believed to enter the basin from the southeast around the bedrock ridge. Surface water from the perennial creek, which enters the site from the uplands to the west, infiltrates into underlying alluvium, adding several hundred gallons per minute to the ground water system. Ground water leaves the site to the north-northeast, parallel to the flow of the Stillwater River.

Ground water levels are shallow at this site. One well completed in the alluvium along the approximate centerline of the potential impoundment dam encountered ground water at 20 feet. Ground water is even shallower in the landslide deposit forming the western margins of the impoundment area. Both wells completed in this landslide material encountered water at depths of less than ten feet.

No water quality information is available for the immediate impoundment area, but based upon nearby alluvial wells, the site's ground water quality is probably good.

Hertzler Valley Site (Alternative 2)

Ground water in the Hertzler Valley is primarily found in two distinct geologic units: sedimentary bedrock and unconsolidated surficial deposits. The majority of the Hertzler Valley is underlain by sedimentary shale and sandstone (see Geology, Bedrock). The bedrock is mantled with up to several hundred feet of unconsolidated glacial and alluvial deposits.

Sedimentary Bedrock. Ground water is available in the sedimentary units, but generally is not used where more reliable near-surface water in unconsolidated deposits exists. Overlying unconsolidated surficial deposits generally can produce greater quantities of ground water and at more predictable depths than the bedrock strata.

Ground water in the sedimentary rocks of the Hertzler Valley generally flows toward the valley bottom, roughly following the relief of the landscape. Much of the lower elevations are underlain by bedrock composed of shale (Colorado Group). The Colorado Shale is roughly 1,000 times less permeable than the overlying sand and gravel. The shale does not allow easy passage of ground water, severely limiting the amount of vertical leakage from the overlying surficial deposits. Alluvial wells, when pumped, dropped water levels slightly in observation wells completed in the shale, which indicates that the upper portion of the shale bedrock is to a small degree hydrologically connected with the overlying saturated unconsolidated material and that some exchange of ground water between the two units is possible.

Unconsolidated Surficial Deposits. The depth of unconsolidated material within the Hertzler Valley varies. The thickest accumulation occurs along the central east-west axis of the valley. The material is composed primarily of a mixtures of alluvial fan and glacial outwash deposits. Most of the ground water in the alluvium moves through the basal coarse-grained deposits (primarily cleaned glacial outwash) in an unconfined (nonartesian) state.

During most of the year, these unconsolidated deposits are saturated with ground water at depths ranging from 90 feet at the western end of the valley to 40 feet at the eastern end, where the Hertzler Valley joins the Stillwater River. Water levels vary with the season: The watertable is highest during the late spring and summer, lowest during winter and early spring. It rises as much as 20 feet from low to high periods.

Ground water always moves from higher to lower ground water table elevations. In the Hertzler Valley, ground water moves down the axis of the valley, from west to east, eventually reaching the Stillwater River Valley. Because the bedrock underlying the valley is of low permeability, the vertical loss of alluvial ground water to the underlying bedrock is minimal.

Ground water can be extracted from the unconsolidated deposits of the Hertzler Valley at high rates. Several observation wells drilled by Anaconda were capable of producing more than 200 gallons per minute (gpm), sufficient for sprinkler irrigation of hay fields.

Infiltration of irrigation waters is a major source of recharge for the valley ground water system: Over half (600 gpm) of the irrigation water brought in from the West Fork of the Stillwater River is lost to infiltration (Anaconda Minerals Company, written com., October 1981). The irrigation ditch runs most of the length of the Hertzler Valley and is used to flood-irrigate hayfields.

Water Quality. The quality of ground water in the unconsolidated deposits of the Hertzler Valley is poor to excellent, depending on what the water is used for. All six observation wells drilled by Anaconda in the unconsolidated deposits tapped ground water of quality suitable for use in irrigation or stock watering, the water's primary use today. Valley ground water was found to be consistently above the recommended drinking water limit for iron. Three of six observation wells also had lead values above the recommended limit for drinking water (4 to 15 times the drinking water standard). Manganese was above the drinking water limit of 0.05 mg/l for four of six wells in the valley (see table in Chapter IV, Hydrology, Ground Water, wells HIA, H3, H4, H5, H6, and H8). In general, alluvial ground water under most of the Hertzler Valley would not be desirable for domestic water supplies. The origin of the constituents that make the water undesirable for drinking water is unknown, but probably is the poor quality water seeping upward from the underlying bedrock and from infiltration of surface water.

Water quality samples taken from two observation wells (H2 and H7) completed in the bedrock that underlies most of the valley (Colorado Shale Group) exceeded the drinking water limits for the following constituents: total dissolved solids, arsenic, cadmium, chromium, iron, lead, manganese, selenium, silver, and sulfate. The poor quality of the water in the Colorado Group rocks, coupled with the very small amount of ground water that could be pumped from the units, makes the Colorado Shale an undesirable ground water source.

The only reported domestic well (R.L. Curtin) in the Hertzler Valley is located within a small unnamed tributary along the north central part of the valley. The water quality of this well, which is not in the main drainageway of the Hertzler Valley, meets drinking water standards.

SOILS

The soils within and near the Stillwater Project have been mapped at two levels of intensity. A detailed (Order I) soil survey was conducted on about 5,320 acres, including the 550-acre proposed permit area. The remainder of the 24,500-acre study area was mapped at a broader (Order III) level.

Overview

The soils in the area studied are variable. This variability stems from differences in climate, vegetation, parent material, topography and time of development (age). In this mountainous area, climate and vegetation are the two predominant factors affecting soil formation. The climate of the region, classified as "mountainous continental," is characterized by large daily and annual temperature ranges, as well as marked differences in precipitation and wind patterns over a distance of only a few miles (see Climate).

A noticeable vegetative and soil change takes place at an altitude slightly above 5,000 feet. Scattered ponderosa pine, Douglas-fir, lodgepole pine, and limber pine generally predominate above this altitude; grass cover predominates below. This creates differences in the soil. As plants die and decompose, they contribute nutrients, litter, and organic matter to the soil. Soils that are formed under grassland at lower altitudes do not leach readily and the subsoils are often calcareous. The organic matter from the grasses is responsible for the characteristically thick, dark-colored, neutral to mildly alkaline surface (A_1) horizon of these soils.

Decomposing litter from a coniferous forest produces more organic acids than decomposing litter from grass. At an altitude above 6,000 feet precipitation increases, temperature decreases, and the soils become more acidic with a lower base exchange. Soils thus develop under conditions of acid hydrolysis. They are characterized by a relatively thin surface (A_1) horizon, a light ashy-colored eluvial (leached) horizon below the surface horizon, and a reddish-colored illuvial (accumulation) horizon below the eluvial horizon.

In the area studied, the materials from which the soil developed (soil parent materials) were derived from locally weathered bedrock or were transported from higher elevations of the Stillwater drainage. The transported material was moved by gravity, wind, glaciers, or water to its present location. Glaciation and water action have performed the dominant role in the evolution of valley topography. Glaciers have left stones--and streams have deposited alluvial gravels--that cap terraces and benches along the valley, as illustrated in fig. III-5. This figure also shows representative soil series for various topographic and geologic locations.

The landscape of the project area exhibits a general soil-plant relationship. The nature of the soil and parent materials determines the kind and, to a considerable extent, the distribution of vegetation, since plant growth is heavily dependent on the chemical and physical characteristics of the soil. However, such factors as past land use practices, micro-relief, and microclimate may have altered the expected soil-plant relationships in some parts of the valley.

Soils of the Proposed Permit Area

The soils of the proposed 550-acre permit area are shallow (less than 20 inches) to deep (40 or more inches), have a coarse to fine texture, are moderately acid to moderately alkaline, are low in soluble salts and sodium, and are low to moderate in water- and nutrient-holding capacity.

The natural soils that would be disturbed at the proposed mine, mill, and tailings areas are generally stony, cobbly, or gravelly and mostly coarse- to medium-textured. Much of the soils occupying the site of the proposed mill and tailings pond have been disturbed by previous mining activities. These soils are highly variable, and therefore cannot be specifically classified. Based on the submitted data, there are no chemical elements in these soils that would pose a hazard to plants, animals, or humans.

Stratton Site Soils (Alternative 1)

Stratton site soils are deep, well-drained and medium-textured. Most of the soils here are either very stony, cobbly, or gravelly, or a combination thereof. In some areas, large boulders are present at the surface and in the soil. The soils are slightly acid to slightly alkaline, are low in soluble

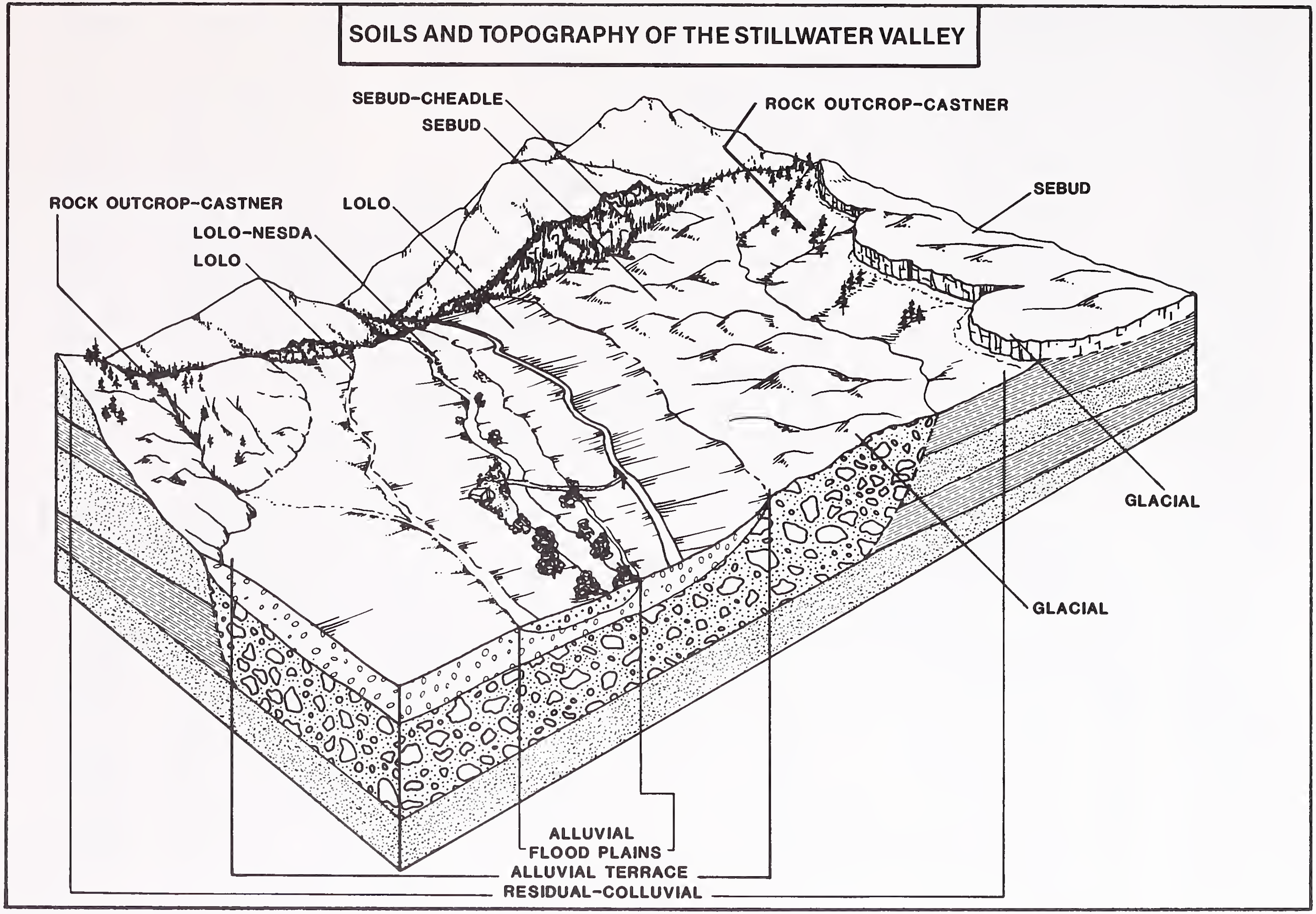


FIGURE III-5

Soils in the project area have developed mostly from weathered bedrock. Glaciers, wind, and water have deposited soils in their current location. The bottom of the valley is capped with stream-laid deposits. Upper slopes are capped with debris (colluvium) that has fallen or washed down from higher elevations.

salts and sodium, and are low to moderate in water- and nutrient-holding capacity. No site-specific chemical data are available for this site; however, based on the site's geology, it is probable that no chemical elements are present in amounts that would pose a hazard to plants, animals, or humans.

Hertzler Site Soils (Alternative 2)

Hertzler site soils are similar to those at the Stratton site. Nearly all Hertzler site soils are deep, well-drained, medium-textured, and very stony. In some places, large boulders are present at the surface and in the soil. The soils are neutral to moderately alkaline, are low in soluble salts and sodium, and are low to moderate in water- and nutrient-holding capacity. Based on the submitted data, there are no chemical elements in these soils that would pose a hazard to plants, animals, or humans.

Prime Farmlands

No prime farmland soils exist in the proposed permit area or in any of the alternatives.

VEGETATION

Vegetation Type Descriptions

The Stillwater vegetation study area (fig. III-6) encompasses about 24,547 acres along the Stillwater River (Camp Dresser and McKee, 1981). Elevations rise from 4,690 feet along the river to 9,050 feet in the southeast portion of the area.

Thirteen vegetation types (fig. III-7 and tables III-2 and III-3), along with water and disturbed areas with no vegetation, have been identified in the study area (see Land Use for range condition and stocking rates).

(1) Stony Grassland. This type occurs on level to rolling foothills and slopes at elevations ranging from 4,756 feet at the valley floor to about 5,248 feet. The type is dominated by perennial forbs and grasses; the remaining vegetation consists of nonflowering plants. Among the forbs, silvery lupine, blazing star, and Hood's phlox are the most abundant (see appendix G for scientific names). Idaho fescue is the most abundant grass; however, needle-and-thread, blue grama, little bluestem, western wheatgrass, and bluegrass are common. Additionally, rock salaginella, sun sedge, and lichens are common.

(2) Sagebrush Shrubland. This type is found on north- and east-facing slopes, where winds commonly deposit snow on the lee side of ridges and knolls. Sagebrush shrubland occurs at low elevations--below 4,920 feet on nearly level to relatively steep slopes.

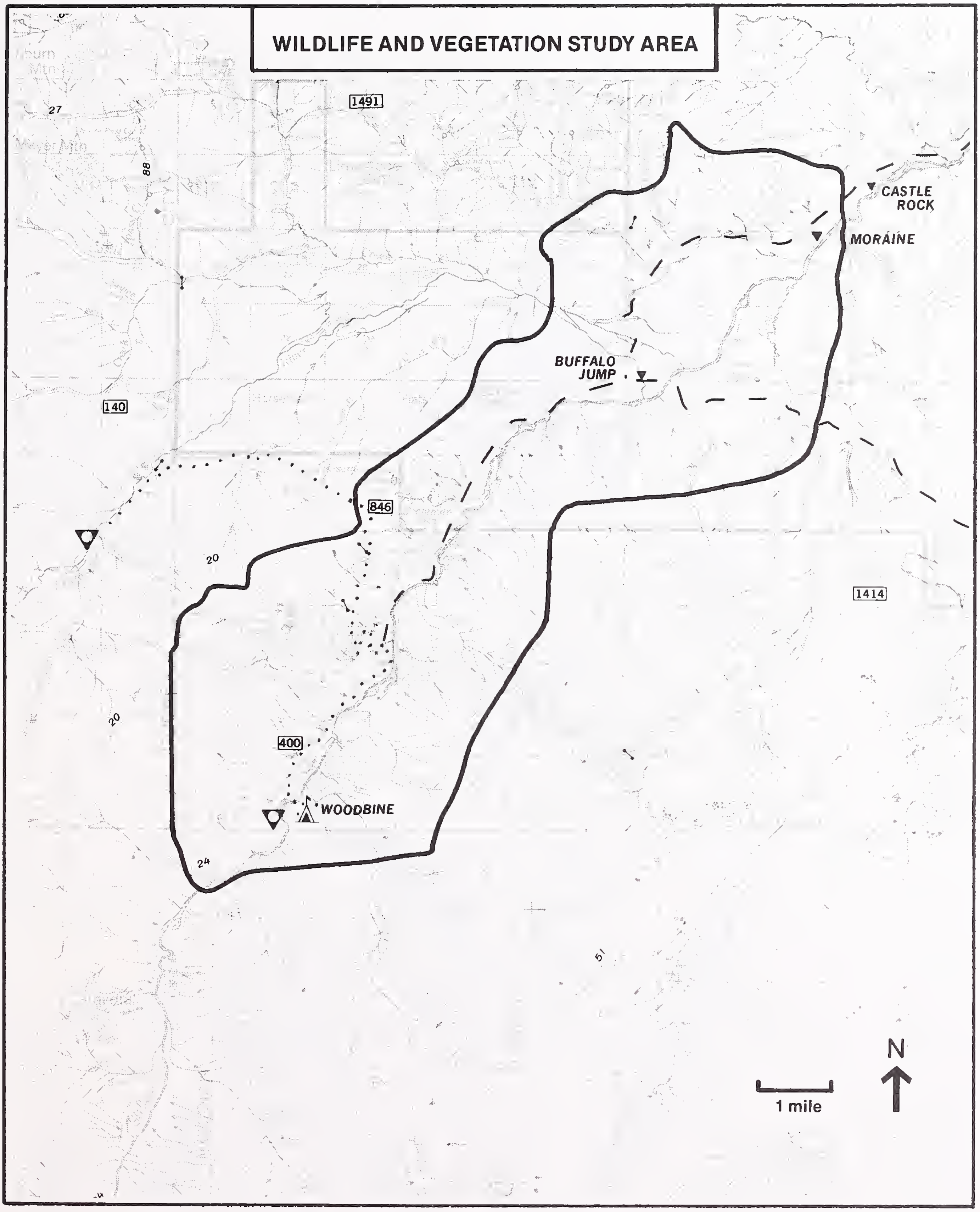


FIGURE III-6

For studies of vegetation and wildlife, Camp Dresser and McKee analyzed a ten-mile-long area that included the Stillwater River Valley and the uplands to either side. All lands considered in alternative tailing sites were included in the CDM study area.

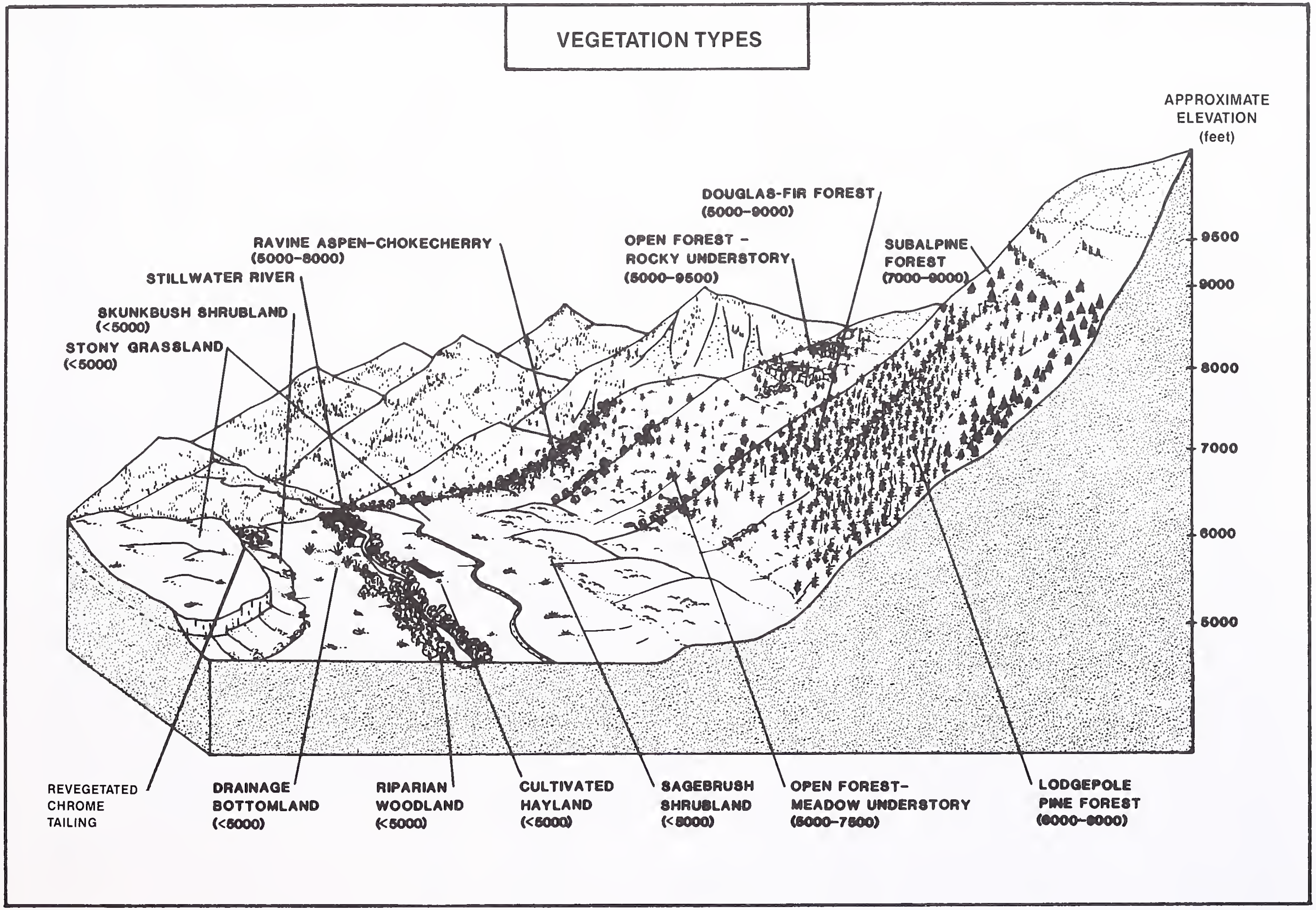

VEGETATION TYPES
APPROXIMATE ELEVATION (feet)
9500
9000
8000
7000
6000
5000
DOUGLAS-FIR FOREST (5000-9000)
RAVINE ASPEN-CHOKECHERRY (5000-8000)
OPEN FOREST - ROCKY UNDERSTORY (5000-9500)
SUBALPINE FOREST (7000-9000)
STILLWATER RIVER
SKUNKBUSH SHRUBLAND (<5000)
STONY GRASSLAND (<5000)
REVEGETATED CHROME TAILING
DRAINAGE BOTTOMLAND (<5000)
RIPARIAN WOODLAND (<5000)
CULTIVATED HAYLAND (<5000)
SAGEBRUSH SHRUBLAND (<5000)
OPEN FOREST- MEADOW UNDERSTORY (5000-7500)
LODGEPOLE PINE FOREST (6000-8000)

FIGURE III-7

The study area contains 13 vegetation types, including the chrome tailings that Anaconda Minerals Company revegetated in the 1950s. Part of the project site lies on lands that have already been disturbed by mining.

TABLE III-2

Vegetation Types in the Stillwater Study Area

	Entire Study Area		Proposed Disturbance Area[1]		Estimated Acres Disturbed by Alternatives[1]	
Vegetation Type	Acres	Percent[2]	Acres	Percent[2]	#1	#2
Stony grassland	6,158	25	3	3	46	131
Sagebrush shrubland	172	1	0	0	0	11
Skunkbush shrubland	995	4	0	0	6	0
Drainage bottomland	320	1	0	0	0	0
Riparian woodland	1,258	5	0	0	0	0
Ravine aspen-chokecherry	552	2	2	1	7	1
Open forest-meadow understory	3,022	12	49	32	60	32
Open forest-rocky understory	5,630	23	28	19	25	25
Douglas-fir forest	2,276	10	1	1	1	1
Lodgepole pine forest	1,832	8	5	3	4	4
Subalpine forest	427	2	5	3	2	2
Revegetated chrome tailings	75	-[4]	0	0	0	0
Cultivated hayland	1,488	6	0	0	0	1
Disturbed lands[3]	332	1	59	38	57	57
Water	10	-[4]	0	0	0	0
TOTAL	24,547	100	152	100	208	265

Source: Camp Dresser and McKee, 1981.

[1] Does not include acres disturbed by slurry lines. Acreages for alternatives 1 and 2 include a 10-acre emergency tailings pond and a 35-acre waste rock dump.

[2] Percentages rounded to nearest whole number.

[3] Disturbed areas include abandoned mine areas, roads, and current disturbances related to SMC's exploratory operations.

[4] Less than 1 percent.

Big sagebrush is the dominant species within this vegetation type. Grass and grasslike species that characterize this type include bluegrass, Japanese brome, needleleaf sedge, and sun sedge. Lupine is a commonly observed forb.

(3) Skunkbush Shrubland. This vegetation type is characterized by skunkbush sumac on south- and west-facing slopes. It is found on steep slopes, usually below 4,920 feet. Dominant grass species include bluebunch wheatgrass and needle-and-thread, along with minor amounts of blue grama, cheatgrass, and bluegrass. Common forbs are Hood's phlox, and slimflower scurfpea. Lichens are also a significant ground cover.

TABLE III-3

Characteristics of Vegetation Types on the Stillwater Study Area

Vegetation Type	Range Site	Range Condition[1]	Perennial Grass Production[2] (lbs/acre/ year)	Shrub Production[2] (lbs/acre/ year)	Deciduous Tree[3] Density (no/acre)	Coniferous Tree[3] Density (no/acre)	Shrub[4] Density (no/acre)
Stony Grassland	Stony	Good (50%)	380	64	0	0	2,231
Sagebrush Shrubland	Stony	Poor (24%)	308	855	0	20	8,478
Skunkbush Shrubland	Stony	Fair (28%)	211	211	0	0	6,455
Drainage Bottomland	Sub-irrigated	Fair (37%)	1,109	456	113	0	2,387
Riparian Woodland	Sub-irrigated	Good (56%)	222	409	1,944	38	37,124
Ravine Aspen - Chokecherry	Sub-irrigated	Good (71%)	83	309	1,945	673	23,877
Open Forest - Meadow Understory	Stony	Excellent (87%)	150	1,046	3	847	9,622
Open Forest - Rocky Understory	None	-	-	-	73	462	4,256
Douglas-fir Forest	None	-	-	-	40	4,948	5,828
Lodgepole Pine Forest	None	-	-	-	8	6,244	7,834
Subalpine Forest	None	-	-	-	0	4,743	8,823
Revegetated Chrome Tailings	None	-	394	0	0	0	0

Source: Camp Dresser and McKee, 1981.

[1] Based on U.S. Soil Conservation Service (1981) methods which do not classify some forested and disturbed areas as rangeland.

[2] Production was not estimated for disturbed, rocky, or densely forested vegetation types.

[3] Woody species reaching 1 cm diameter at 130 cm were defined as trees. Densities were not estimated for cultivated hayland or disturbed areas with no vegetation.

[4] Fringed sagebrush not included.

(4) Drainage Bottomland. This is a wet-meadow type generally found in swales or low-lying areas and dominated by wetland grasses and forbs. The vegetation has been strongly influenced by grazing, irrigation, and other disturbances, often resulting in a weedy species composition. This type occurs on level terrain between 4,756 and 5,018 feet.

Dominant grasses include bluegrass, needle-and-thread, and meadow fescue. Sedge and rush species include beaked sedge, Tule bulrush, and spikesedge. Common dandelion, red clover, and field mint are the most abundant forbs.

(5) Riparian Woodland. This vegetation type occurs on the banks, bottoms, and floodplains along major streams and rivers in the study area,

usually at elevations between 4,756 and 5,248 feet. Deciduous trees, growing along the Stillwater River and its tributaries, are the most prominent feature.

The riparian woodland type is dominated by a tree overstory composed primarily of black cottonwood intermixed with balsam poplar and quaking aspen. Other tall woody species include willows, alders, birches, common chokecherry, and red-osier dogwood. Shrubs, such as whortleleaf snowberry and Wood's rose, are found in the understory. Ground cover is provided by bluegrass, redtop, and cutleaf coneflower.

(6) Ravine Aspen-Chokecherry. This vegetation type is characterized by patches of quaking aspen and common chokecherry, which occur on slopes near seeps and springs or in areas where ground water is near the surface. This type differs from the streamside riparian woodland type in that it is not always associated with surface water and occurs on steep mountain slopes between 4,920 and 8,200 feet.

The overstory consists of quaking aspen intermixed with shorter woody species such as chokecherry, birch, and Rocky Mountain maple. Frequently occurring shrub species include whortleleaf snowberry, mountain ninebark, and horizontal juniper. Forb species include cutleaf coneflower, cow parsnip, meadow aster, and wartberry fairybells. Grass species are relatively unimportant in this vegetation type.

(7) Open Forest-Meadow Understory. This is a transitional type between forest and grassland types. It occurs on level areas to steep slopes, on all aspects, and at mid-elevations between 5,248 and 7,616 feet.

Scattered Douglas-firs and limber pines are surrounded by dense herbaceous vegetation. Forb species are abundant and include arrowleaf balsamroot, spreading dogbane, field chickweed, and silvery lupine. Common grasses are bluebunch wheatgrass, bluegrass, Idaho fescue, and needle-and-thread. Dominant shrubs include mountain ninebark, horizontal juniper, skunkbush sumac, and fringed sagebrush.

(8) Open Forest-Rocky Understory. This transitional type occurs between forest vegetation types and bare rock outcrop, cliffs, and talus slopes. It is found on moderate to steep slopes at elevations between 4,838 and 8,856 feet. Scattered Douglas-fir and limber pine trees are the dominant species, although ponderosa pine and lodgepole pine occasionally occur. Some shrubs found in significant amounts include common juniper, horizontal juniper, and mountain ninebark. Grasses and forbs contribute relatively minor amounts to the vegetative cover. Lichens are the dominant ground cover.

(9) Douglas-fir Forest. This type is located at elevations between 5,002 and 8,856 feet on level areas to steep slopes. Douglas-fir is the dominant tree. The only frequently encountered shrub is common juniper. Forb species, such as spreading dogbane, loose-flowered milk vetch, and white spirea, contribute a small amount of vegetative ground cover. Grasses and sedges are present in small, often trace amounts.

(10) Lodgepole Pine Forest. The lodgepole pine forest type is frequently located on the bottom and sides of broad, U-shaped glaciated valleys from 6,232 up to 8,856 feet. Slopes are nearly level to steep. Lodgepole pine is the primary overstory species; however, Douglas-fir grows in the more mature, open stands. Lodgepole pine is often considered to be a seral (temporary) species replaced gradually by Douglas-fir, forming a Douglas-fir forest vegetation type at the climax (mature, stable) stage (Pfister et al., 1977). Limber pines are occasionally found growing within lodgepole and Douglas-fir stands.

Dense stands of lodgepole pine frequently have little or no understory vegetation. Plant growth is inhibited by a dense mat of pine needles and lack of sunlight. The more open stands contain a shrub understory of shrubs as common juniper, mountain ninebark, Wood's rose, and kinnikinnick. Lichens and mosses are often found beneath the woody overstory. Grasses and sedges contribute little to vegetative ground cover.

(11) Subalpine Forest. Vegetation within this type varies with topography, aspect, moisture, and soil. The type is located on mountain tops and slopes, glaciated valley sides, and basins between 7,052 and 8,856 feet in elevation.

The tree overstory is characterized by subalpine fir mixed with Engelmann spruce, limber pine, Douglas-fir, and lodgepole pine. Vegetation beneath the trees varies with available soil moisture and divides the subalpine forest into three phases. The moist phase forest is dominated by a huckleberry understory. Forbs, in addition to huckleberry, differentiate the intermediate moisture phase. The dry moisture phase forest is characterized by common juniper, white spirea, and lichens.

(12) Revegetated Chrome Tailings. In the 1950s, Anaconda revegetated an abandoned tailings pond. Alfalfa contributes about half of the present vegetative cover. Yellow sweetclover grows among the alfalfa. Fringed sagebrush is common. Grass species include intermediate wheatgrass, bluebunch wheatgrass, and cheatgrass.

(13) Cultivated Hayland. This type is found in low-lying areas which are flood irrigated or subirrigated. It is used as pasture for livestock or for hay production. Major species are intermediate wheatgrass, alfalfa, timothy, orchard grass, and brome grass.

(14) Disturbed Lands. Included in this type are the old Mountain View townsites, the old chromite stockpile area, the reclaimed chrome concentrator site, and percolation ponds. SMC has added buildings, ore stockpiles, parking lots, and other facilities to the prior disturbances. Vegetation is highly variable and was not quantitatively examined during baseline inventories. Generally, reclaimed sites are visually dominated by alfalfa, yellow sweetclover, and wheatgrass. Other areas are in seral stages resembling the stony grassland or open forest-meadow understory types and contain introduced shrubs and forbs.

(15) Water. Surface water sources large enough for mapping are included in this type.

National Forest Timber Resources

Mining would affect some timbered areas within Custer National Forest. Predominant tree species are lodgepole pine, Douglas-fir, and limber pine. The harsh sites and overstocked conditions limit growth. Most trees are pole sized or poorly formed small saw timber. All stands are of low commercial value due to poor quality timber and the rugged terrain's limits on harvest operations.

No significant quantities of timber have been harvested from the proposed or alternative disturbance areas. Some pole or prop material may have been cut from the proposed area during previous mining activities. There is no current plan for harvesting timber from the area and it is unlikely that timber will ever be of commercial value. The principle values of trees are for wildlife habitat, watershed protection, and scenery.

Noxious Weeds

Noxious weeds such as spotted knapweed and Canada thistle have been observed on old abandoned roads on the mountainside above the minesite facilities. No attempt has been made to reclaim these roads. They were built and abandoned before current state and federal reclamation laws were adopted.

AQUATIC ECOLOGY

Five streams lie near the proposed Stillwater Project: Stillwater River, West Fork of the Stillwater River, Verdigris Creek, Mountain View Creek, and Nye Creek. Aquatic invertebrate and periphyton information was obtained from a 1980-81 study prepared for Anaconda Minerals Company (CDM, 1981). During that study, ten aquatic sampling stations were established within the project area, including six stations on the Stillwater River, and one each on the West Fork of the Stillwater River, Verdigris Creek, Mountain View Creek, and Nye Creek (fig. III-8). Supplemental information was collected from the Montana Department of Health and Environmental Sciences, the Montana Department of Fish, Wildlife and Parks, the U.S. Forest Service, and the U.S. Fish and Wildlife Service.

The quality of aquatic habitats at the ten stations studied by CDM ranged from undisturbed conditions near station S-1 to habitats affected by windblown tailings at station NC-1 on Nye Creek. The aquatic habitats--including the riparian zone--of all stations located on the Stillwater River and the West Fork of the Stillwater River were in stable condition and exhibited stream habitat conducive to aquatic insect production.

Degraded aquatic habitats were found in the three tributary streams. Verdigris Creek contains elevated concentrations of metals that may result from the stream passing through an area of decomposed rock rich in oxidized metal pyrites. Suitable habitat for aquatic insect production is limited in the lower portion of Mountain View Creek because of chromium ore concentrates and in the lower part of Nye Creek because of mine tailings.

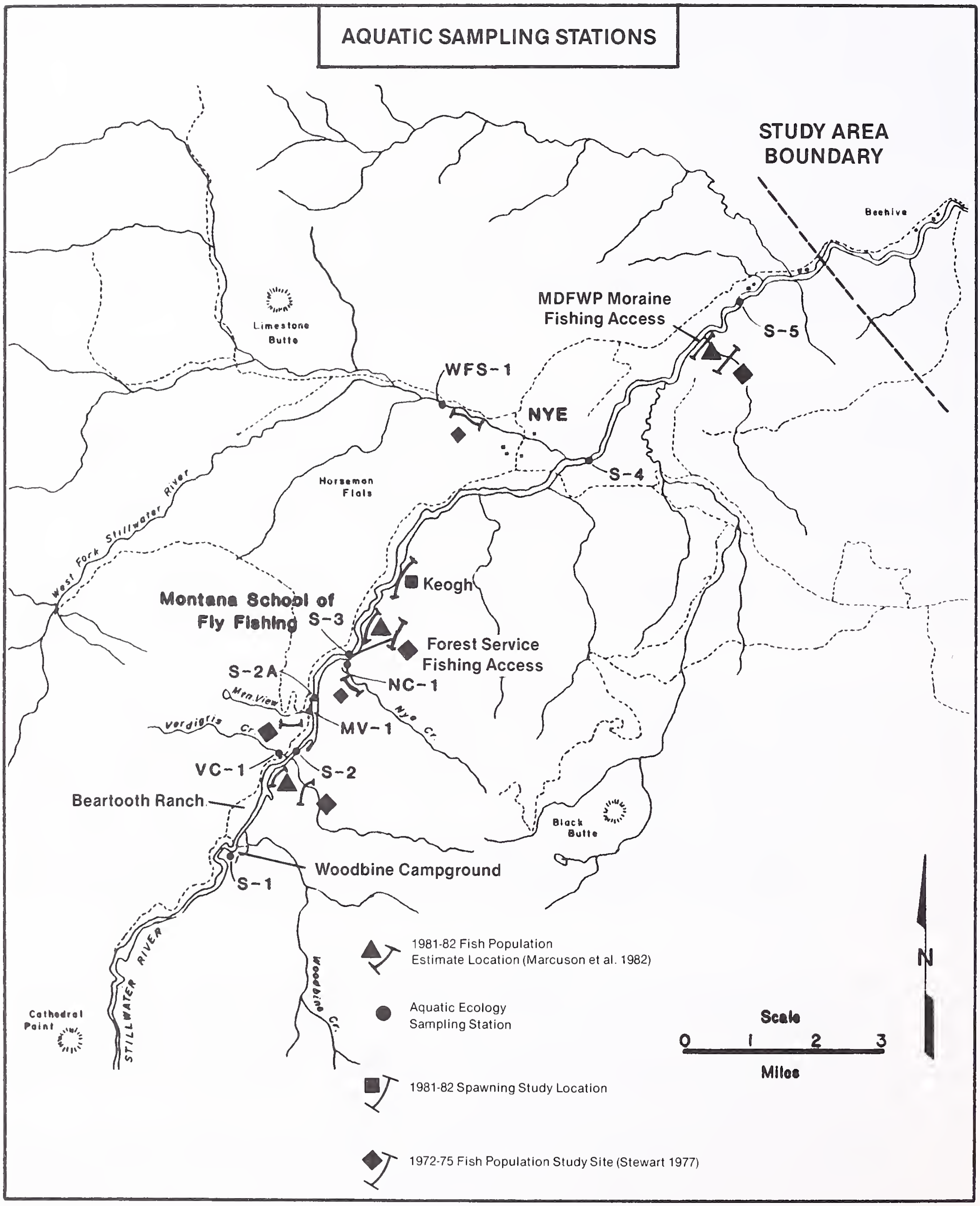

AQUATIC SAMPLING STATIONS
STUDY AREA BOUNDARY
Beehive
MDFWP Moraine Fishing Access
S-5
Limestone Butte
WFS-1
NYE
S-4
Horseman Flats
West Fork Stillwater River
Keogh
Montana School of Fly Fishing
S-3
Forest Service Fishing Access
S-2A
NC-1
Mtn View
Verdigris Cr.
MV-1
Nye Cr.
VC-1
S-2
Beartooth Ranch
Black Butte
Woodbine Campground
S-1
Stillwater River
Woodbine Cr.
Cathedral Point
1981-82 Fish Population Estimate Location (Marcuson et al. 1982)
Aquatic Ecology Sampling Station
1981-82 Spawning Study Location
1972-75 Fish Population Study Site (Stewart 1977)
Scale
0
1
2
3
Miles
N

FIGURE III-8

A number of stations were established along the Stillwater River and its tributaries to assess aquatic habitat and fisheries. The West Fork and main stem of the Stillwater are of high aquatic quality, although in places Verdigris, Mountain View, and Nye creeks are degraded.

Aquatic Invertebrates

The aquatic invertebrate communities in the Stillwater River near the project area were found to be highly diverse and abundant. Densities of aquatic invertebrates ranged from 3,905 organisms per square meter at station S-2 to 29,290 organisms per square meter at station S-4. The density of organisms in the Stillwater River increased in a downstream direction. Between 17 and 46 different kinds of aquatic insects were collected at each of the stations located on the Stillwater River and West Fork of the Stillwater River.

Organisms collected included many that are sensitive to environmental degradation (e.g., the mayflies *Rithrogena*, *Epeorus*, *Ephemerella*, *Heptagenia*, and *Pseudocloen*; the stoneflies Chloroperlidae and Nemouridae; and the caddisflies *Rhyacophila* and *Arctopsyche*). Their presence indicates good water quality and good aquatic habitat conditions. The aquatic insect communities were also functionally diverse (Cummins, 1978) with representative algae scrapers (*Baetis*, *Epeorus*), predators (*Isoperla* and *Rhyacophila*), collectors (*Ephemerella*) and filter feeders (*Arctopsyche* and *Simulium*) found throughout the study area.

The diversity of aquatic invertebrates found within the tributary streams was lower than in the Stillwater River. Mountain View Creek was the most diverse of the three tributary streams with 21 invertebrate organisms, followed by Verdigris Creek with seven and Nye Creek with six. The paucity of aquatic insect types in these streams was probably directly related to the quality of aquatic habitats.

Periphyton

Periphyton is a group of a variety of organisms, including bacteria, protozoa, and algae, that are attached to rocks, plants, or other stream substrates. Data collected during three sampling periods (spring, summer, and fall) in the Stillwater River and the West Fork of the Stillwater River indicate a diverse periphyton community.

Diversity indexes ranged from approximately 1.2 at S-1 to 3.5 at S-5. The diversity index tends to be high when there is a large number of species and when individuals are evenly distributed. Within the study area, diversity was highest in downstream reaches of the Stillwater River and at the sampling station on the West Fork of Stillwater. The dominant taxonomic groups of periphyton found included the Bacillarophyta (diatoms) and Chrysophyta (yellow-green algae). These two groups made up from 13 to 93 percent (diatoms) and from 0 to 81 percent (yellow-green algae) of the total periphyton collected during the three sampling periods. Cyanophyta (blue-green algae) and Chlorophyta (green algae) were important components during the summer samplings: Blue-green algae species made up as much as 65 percent, and green algae as much as 52 percent, of the total number of organisms present at any one station. Green algae were also important during the fall sampling, composing as high as 56 percent of the total numbers per station. Other taxonomic groups such as Euglenophyta (euglenoids) and Pyrrhophyta (dinoflagellates) were only minor components of the samples.

Several of the periphyton species collected are indicators of good water quality. The diatom Achnantes minutissima was one of the most abundant organisms sampled and is an indicator of high dissolved oxygen concentrations. The yellow-green alga Hydrurus foetidus was also abundant and is characteristic of streams having good water quality, high velocities, and cool temperatures. The dominance of diatoms at most stations in the Stillwater River and West Fork of the Stillwater River is characteristic of aquatic ecosystems that are largely undisturbed.

FISHERIES

The Montana Department of Fish, Wildlife, and Parks considers both the Stillwater River and its West Fork, both near or downstream from proposed mining operations (fig. III-8), to be "substantial fishery resources." Stewart (1977) used electrofishing to sample fish populations in both streams. The same technique was employed by Marcuson et al. (1982) to re-examine the Stillwater River. These reports are summarized below.

Stillwater River

The 1981-82 study area consisted of three population estimate stations and one brown trout and whitefish spawning study station (fig. III-8). Population estimate stations roughly corresponded to sites used in the early 1970s. Spawning study sites were also located below the town of Absarokee.

Electrofishing studies focused on brown trout, rainbow trout, brook trout, and mountain whitefish (see appendix H for scientific names). These game species make up most of the fish biomass in the Stillwater River. Cutthroat trout were last collected in 1974. Rainbow-cutthroat hybrid trout are infrequently encountered. Nongame fish present throughout the river include longnose sucker, mountain sucker, longnose dace, and white sucker. Mottled sculpin and shorthead redhorse inhabit the mouth of the river.

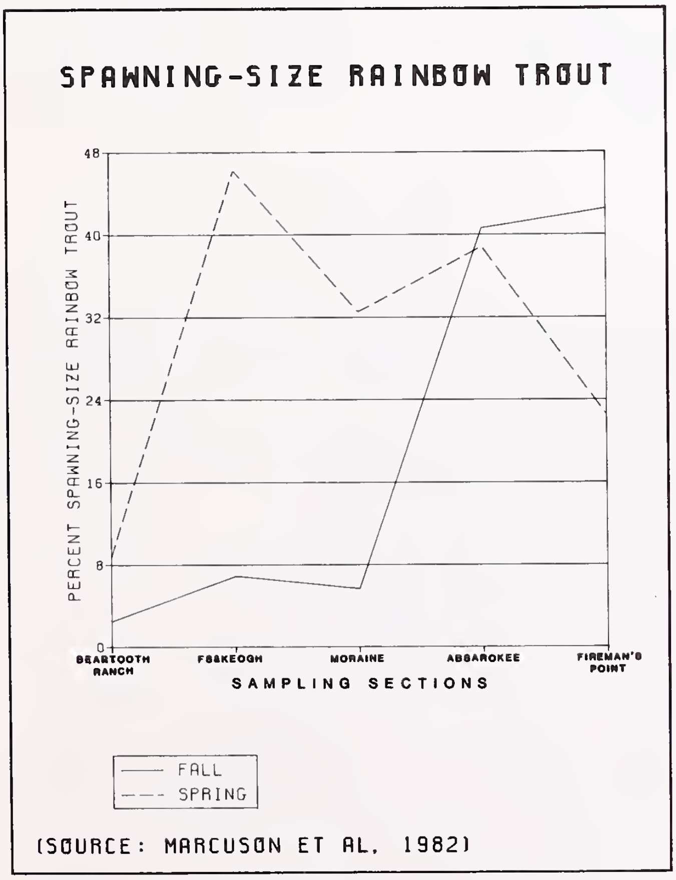
The composition of game fish in the study area varies seasonally. Brown trout and whitefish are the most common fish in the area in the fall. In spring, rainbow trout increase in number. Just the reverse is true in the lower Stillwater River (below Absarokee), from where the species migrate. The year-long average species composition of the study area was 35 percent brown trout, 33 percent mountain whitefish, 27 percent rainbow trout, and 5 percent brook trout. In the lower river, the comparable composition was 50 percent whitefish, 27 percent brown trout, and 13 percent rainbow trout.

Brown trout densities in the study area increased from 184 yearling and older fish per 1,000 feet of river in the spring to 215 per 1,000 feet in the fall, a 16.8 percent increase. The density of fish in the favored spawning areas within the study area increased 84 percent from spring to fall. Browns tended to move upstream into the study area to spawn, then gradually shifted back downstream. The longest distance traveled by a brown was 56 miles.

A resident population of 309 rainbow trout per 1,000 feet of river existed in the upper reaches of the study area. The fall population consisted mainly of offspring of migrant spring spawners, some stocked fish, and a few residents. Seventy percent of the entire rainbow population were young of the year, 17 percent were age 1, and 13 percent were age 2 or older. The lower river had a fall density of 142 rainbows per 1,000 feet. The catch of yearling or older rainbows per unit effort (CPUE) per 1,000 feet was four during the fall and nine during the spring in the study area. In the lower Stillwater, the CPUE was seven in spring and four in the fall. Ninety percent of all juvenile rainbows sampled in the entire river were found in the study area.

Migrant rainbow trout from the Yellowstone and lower Stillwater Rivers began moving into the study area the third week of April. Their numbers peaked on April 29 and their spawning ended by May 12. Return downstream followed spawning.

In the study area, the proportion of spawning-size rainbow trout (12 inches and larger) increased from 3 percent in the fall to 40 percent in the spring (fig. III-9). The percent of spawning-size rainbows in the entire Stillwater River during the fall was 16.2, while in the spring it was 30.5, indicating that about 47 percent of the spawners in the Stillwater River migrate up from the Yellowstone River. Of the 14 captured and marked rainbow that migrate between the study area and areas downstream, 64 percent moved to or from the lower Stillwater River, while 36 percent moved to or from the Yellowstone River.


SPAWNING-SIZE RAINBOW TROUT

(SOURCE: MARCUSON ET AL. 1982)

FIGURE III-9

Near the project area, the percentage of rainbow trout of spawning size varies markedly. (The Absarokee and Fireman's Point sites are downstream of the town of Absarokee.)

Mountain whitefish densities increased from 39 to 291 per 1,000 feet from spring to fall in the study area, a 646-percent increase. No extreme movements were observed; marked fish tended to shift upstream to favored spawning sites in mid-October. Juveniles emerged in February, drifted downstream, and began a gradual upstream trek as water temperatures increased to 48°F during spring discharges preceding the June runoff.

The 3-year, 1972-1974, mean density of brook trout was 93 per 1,000 feet in the study area. The mean CPUE for these 3 years was 4 per 1,000 feet. No estimates were made in 1981, due to low densities. The mean CPUE in 1981 was 0.3 per 1,000 feet. Only four brook trout were captured in 18 electrofishing runs in the lower Stillwater.

The nature of the gravel substrate, shallow side channels, flow regimens, water quality, and stream gradient make the river in the study area ideal for spawning and rearing of game fish that live in the lower Stillwater and Yellowstone Rivers. The river environment downstream from Beehive, Montana, is suitable for year-round occupancy, but does not provide the ideal spawning and rearing habitat of the study area.

West Fork of the Stillwater River

Electrofishing revealed that brown trout, rainbow trout, brook trout, and mountain whitefish inhabit the lower West Fork of the Stillwater River. Population estimates were made only for the more prevalent brown and rainbow trouts. The West Fork supports about 300 brown trout and 100 rainbow trout per 1,000 feet of stream. Five percent of the browns had reached at least age 3, averaging 12.6 inches long. Rainbows attaining age 2 or more, 58 percent of the population, averaged 7.8 inches long.

WILDLIFE

This section is based on wildlife studies conducted by the Montana Department of Fish, Wildlife, and Parks (MDFWP) and Camp Dresser and McKee (CDM), a consulting firm. The MDFWP reported primarily on deer, elk, and bighorn sheep (Youmans, et al. 1982; Stewart, 1984). Marked or radio-collared animals were monitored from 1980 to 1982 to determine distribution and movements. Other MDFWP publications provided supplementary big game information. A one-year baseline inventory supplied information on other wildlife species and wildlife habitats (CDM, 1981). All reports are on file with the Department of State Lands and available for public review. The areas studied by MDFWP and CDM are shown in figures III-6 and III-10.

The Stillwater wildlife study areas support diverse and abundant wildlife populations. During the baseline inventory, 143 bird, 34 mammal, 6 reptile, and 1 amphibian species were observed. Important winter ranges for elk, mule deer, and bighorn sheep occur within the study area (see appendix I for scientific names of wildlife species). Vegetation types and topography

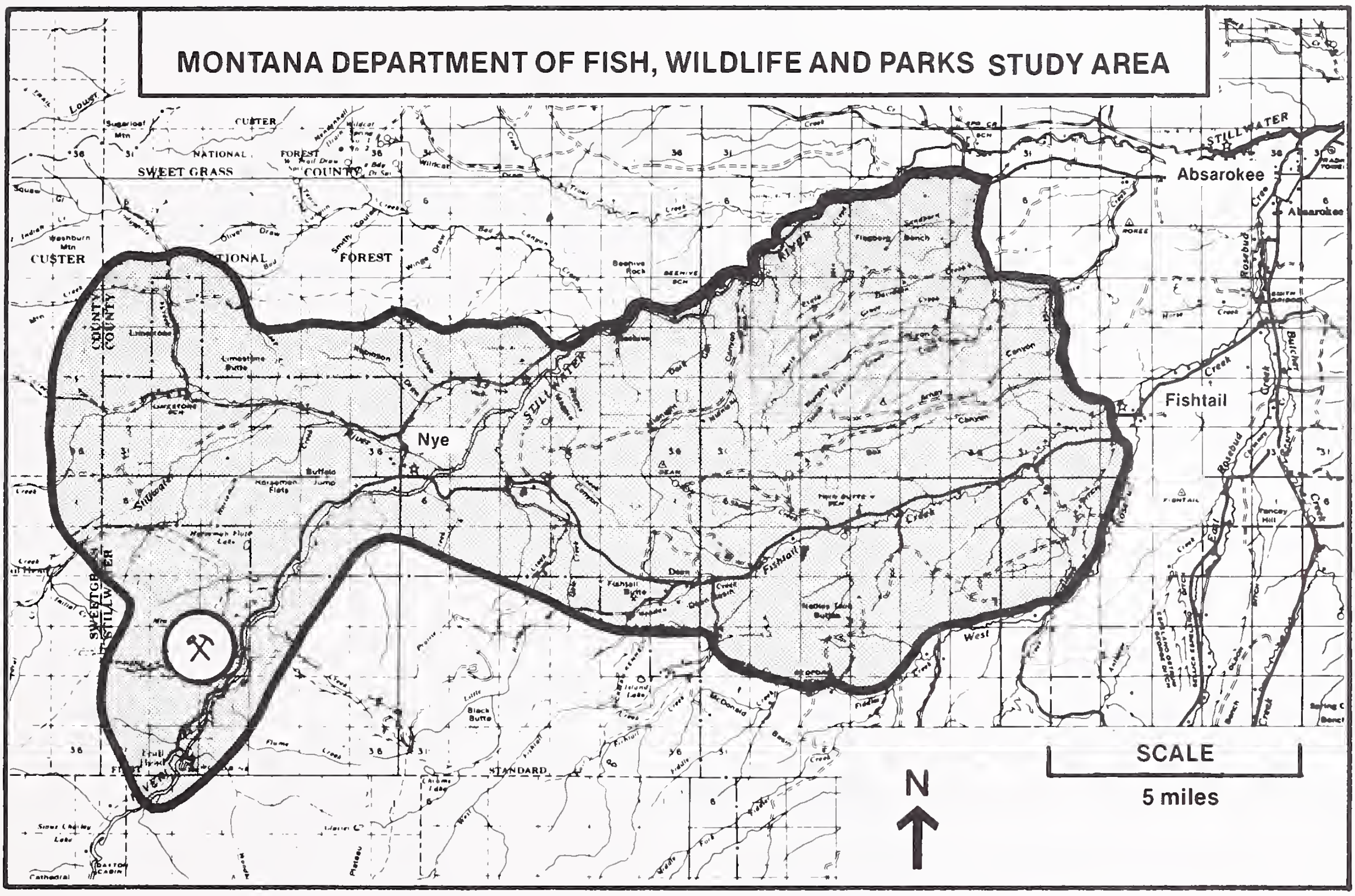


FIGURE III-10

For wildlife studies, the Department of Fish, Wildlife, and Parks analyzed a larger area than did Camp Dresser and McKee (fig. III-6). The Department of Fish, Wildlife, and Parks studied big game.

combine to meet the habitat requirements of various species. Wildlife habitat types (table III-4 and fig. III-11) correspond to vegetation types previously described. (See Vegetation.) The open Douglas-fir forest and the stony grassland habitat types make up over half the CDM study area.

Big Game Species

Mule Deer

Mule deer were the most common big game animal in the MDFWP study area, particularly during the winter. The population of mule deer was estimated at 5,900 during the March 1982 survey. Densities varied by survey unit from 18 to 82 per square mile (table III-5).

Total numbers of mule deer in the area are affected by winter conditions. The 1980-81 winter was relatively mild. Some deer may not have moved into the area because they found adequate food and shelter elsewhere. Somewhat harsher weather in 1982 corresponded with increased numbers of deer. Youmans et al. (1982) believe that a severe winter would further increase deer numbers.

TABLE III-4

Wildlife Habitat Types and Corresponding Vegetation Types in the CDM Wildlife Study Area

Wildlife Habitat Types	Acres	Percent of Study Area	Corresponding Vegetation Types
Boulder and Talus Field	189	1	Open Forest-Rocky Understory
Closed Douglas-fir Forest	2,070	9	Douglas-fir Forest
Closed Douglas-fir/ Lodgepole Pine Forest	161	1	Lodgepole Pine Forest
Closed Lodgepole Pine Forest	1,576	7	Lodgepole Pine Forest
Hay Meadow	1,328	6	Cultivated Hayland
Disturbed Forest	161	1	Open Forest-Meadow Understory Lodgepole Pine Forest
Disturbed Grassland	184	1	Revegetated Chrome Tailings
Disturbed Meadow	<1	T	Open Forest-Meadow Understory
Disturbed Shrubland	5	<1	Revegetated Chrome Tailings
Drainage Bottom Meadow	267	1	Drainage Bottomland
Mosaics[1]	479	2	--
Open Douglas-fir Forest	7,265	32	Open Forest-Meadow Understory Open forest-Rock Understory
Palustrine	30	1	--
Ravine Aspen	557	2	Ravine Aspen-Chokecherry
Riparian Woodland Meadow	1,134	5	Riparian Woodland
Rocks Cliffs/Benches	806	4	Douglas-fir Forest, Open Forest-Rocky Understory
Sagebrush Shrubland	324	1	Sagebrush Shrubland
Skunkbush Shrubland	615	3	Skunkbush Shrubland
Stony Grassland	5,323	23	Stony Grassland
Upland Grassland	338	1	Stony Grassland
TOTAL	22,812	100[2]	

Source: Camp Dresser and McKee, 1981.

[1] Mosaics represent the edge between two or more habitat types and do not have a corresponding vegetation type.

[2] Rounded to 100 from 101.

The mule deer population appears to be increasing. Production rates were high during fall 1981, when there were 78 fawns per 100 does. Few fawns died during the preceding winter (Simmons et al., 1981). As a result, a large percentage of the deer were yearlings during 1981. Of the adult males captured and marked, none were older than 2 1/2 years. This may result from an inability to capture older males, unusually high death rates of older males, or emigration.

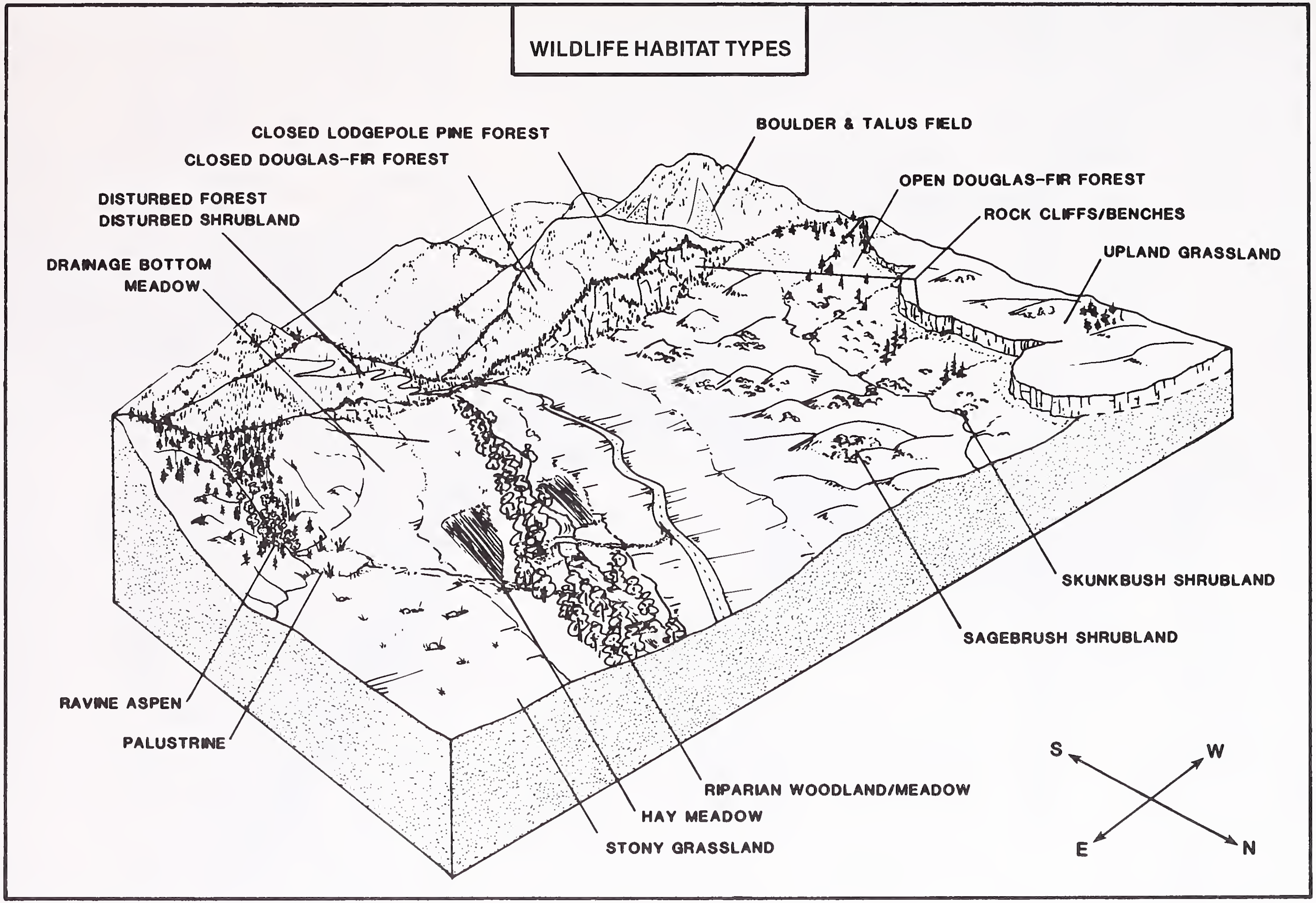


FIGURE III-11

Wildlife habitat types correspond to vegetation types. The most common habitat types are Douglas-fir forest and stony grassland.

TABLE III-5

Mule Deer Population Estimates
by Helicopter Survey Unit, MDFWP Study Area
March 1981 and 1982

Survey Unit	Unit Size (square mile)	Population Estimates 1981	Population Estimates 1982	Densities (deer/square mile) 1981	Densities (deer/square mile) 1982
1	16	1,157	1,318	72	82
2	15	443	406	30	27
3	7	71	124	10	18
4	13	292	204	22	16
5	6[1]	328	916	55	44
6	36	490	884	14	25
7	18	822	1,351	46	75
8	9[2]	321	597	36	63
TOTALS	120[3]	3,924	5,800	33[4]	43[4]

Note: Estimates by the Lincoln-Petersen Index, based on the proportion of marked animals observed (Overton and Davis, 1969).

[1] Enlarged to 21 square miles in 1982.

[2] Enlarged to 11 square miles in 1982.

[3] Enlarged to 137 square miles in 1982.

[4] Mean total density.

Observation of marked deer allowed the identification of four distinct winter range units: (1) Beartooth, (2) Keogh, (3) Limestone, and (4) Stillwater (fig. III-12). Deer from different winter ranges exhibited different migratory patterns. Movements of three does from the Beartooth unit indicated the migratory nature of that unit's deer. These individuals moved south along the Stillwater River, reaching the Slough Creek Campgrounds (in Yellowstone National Park) in late May. Does inhabiting the Keogh and Stillwater units have small home ranges. Although some bucks migrate, most deer probably reside year-round in these two units. Seasonal movements of deer in the Limestone unit have not been classified. However, a few marked animals made extensive movements to the northeast, leading Youmans et al. (1982) to speculate that at least some Limestone unit deer summer in the drainages of the East Boulder River. Additionally, the animals in the unit have the largest winter-spring movements. Most migratory deer return to winter ranges by mid-December.

Habitat use by deer was separated into spring/summer and fall/winter sightings. Two types of data collection (vehicle/pedestrian and aerial surveys) were used and yielded different results. During spring and summer, 41 percent of ground observations were made in the stony grasslands, while 30

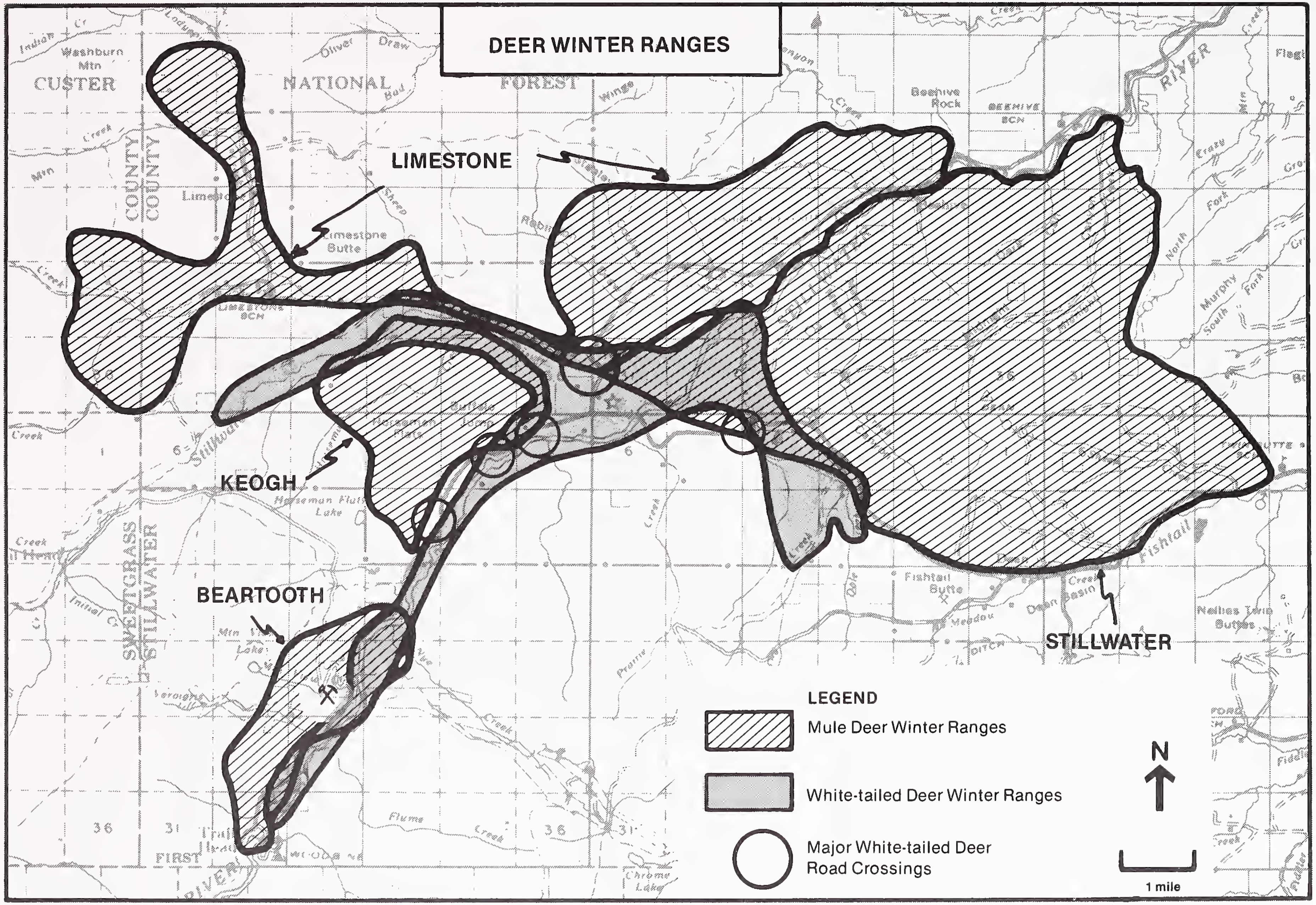


FIGURE III-12

Mule deer use four distinct winter ranges. White-tailed deer use one contiguous range along the valley bottom. Five sites in the valley bottom have been identified as major road crossings for deer.

percent were made in hay meadows. Aerial surveys differed considerably; upland grasslands (26 percent) and sagebrush shrublands (25 percent) accounted for most observations. Aerial surveys indicated a lower use in stony grassland (15 percent) and higher use of skunkbush shrublands (17 percent) and open Douglas-fir forests (13 percent).

The results of ground surveys during fall and winter were similar to spring and summer surveys. Use of stony grassland was essentially the same (41 percent), although sightings in hay meadows decreased somewhat (21 percent). Use of open Douglas-fir types increased (12 percent). Results of aerial surveys were again different from ground surveys. The highest use shown by this technique was in open Douglas-fir forests (32 percent). Sagebrush shrublands were used 21 percent of the time, upland grasslands 19 percent of the time, and stony grasslands 13 percent of the time.

Differences in results between aerial and ground surveys were probably due to observer bias, differences in observability due to type of technique used, and observability differences between habitats.

White-tailed Deer

During the 1800s white-tailed deer were described as "fairly abundant" in the Beartooth Mountains; by 1910 they had dwindled to "very scarce" (Cooney, 1936). The Montana Department of Fish and Game transplanted whitetails to the Beartooth Mountains from 1945-1947. Approximately 20 deer were released near the Beartooth Ranch during two years (1945 and 1946). The total population was estimated at 100 in 1949 (Stoneberg, 1977). A population estimate using marked deer was conducted on March 17, 1982, by Montana Department of Fish, Wildlife, and Parks personnel. The department estimated that 251 animals were within the area, a density of 19 white-tailed deer per square mile.

Stoneberg (1977) described whitetail range as a wide corridor along the Stillwater River between Nye Creek and Little Rocky Creek and another corridor along the West Fork of the Stillwater to Horseman Flats (fig. III-12). Whitetails have also been observed as far south as Woodbine Campground and as far north as the Meyer Creek area. Although six of seven radio-collared animals limited winter (1982) movements to less than a square mile, some neck-banded individuals traveled up to 2 miles from their capture sites. Movements increased during spring; two radio-collared does moved 15 to 22 miles northeast of Nye. Additional observations of marked deer indicate that, at least during spring, whitetails use habitats outside the range identified by Stoneberg (1977). Deer from the Stillwater population were sighted 22 to 32 miles southeast of Nye. Five deer crossings have been identified on roads north of the proposed mine (fig. III-12).

Fawn production rates were excellent during 1981. Fall counts indicated 125 fawns per 100 does. Spring surveys conducted in hunting districts 520 and 572, containing the Stillwater study area, revealed the highest fawn:adult ratio in recent years (Simmons, 1981).

Habitat use, as determined by aerial surveys, was concentrated in three habitats. In spring and summer white-tailed deer used stony grassland 63 percent of the time, hay meadows 23 percent of the time, and riparian woodland meadows 5 percent of the time. In fall and winter whitetails used stoney grasslands 15 percent, hay meadows 38 percent, and riparian woodland meadows 31 percent of the time. Riparian habitat use was probably underestimated because of the low visibility within this habitat.

Bighorn Sheep

Bighorn sheep in the upper Stillwater River Valley have been studied since 1971 (Stewart, 1975; Stoneberg, 1977; CDM, 1981, Youmans et al., 1982; Stewart, 1984). Stoneberg (1977) reviewed USFS and MDFWP population data and made almost daily winter-spring observations from 1971 through 1976. Since 1976, bighorn observations have been made at approximately weekly intervals. The studies reveal that herd size peaked in 1977-78 at 60 animals, then dropped to 51 to 55 animals (table III-6). The 1982-83 census revealed a further decline in population and lamb:ewe ratios. The population increased slightly in 1983-84, although lamb:ewe ratios remained the same. Both population and lamb:ewe ratios remain above those recorded in the 1950s and 1960s. Stoneberg (177) stated: "It appears 40-50 sheep was the carrying capacity" of bighorn winter range. Youmans et al. (1982) and Stewart (1984) noted that low lamb:ewe ratios occurred during mineral exploration activities.

The major winter concentration area for bighorn sheep lies between the Mouat Mine and Woodbine Trailhead, along the west side of the Stillwater River (fig. III-13). This winter range covers only about three square miles and is used by all members of the Stillwater herd at some time during the winter. A peripheral winter range, used by fewer than 10 bighorn, is found on the east side of the Stillwater River (fig. III-13). Most bighorns arrive on the winter range by mid-October and stay for 8 to 9 months. All rutting (mating) activities occur on the major winter range. Important areas during the rut are the cliff south of SMC headquarters, the Woodbine Trailhead vicinity, and the Stillwater Canyon north of Verdigris Creek. After the rut, mature rams separate from the rest of the herd and use reclaimed mine roads near Verdigris Creek. They do not mix with the other bighorns until a three-week period in March and April. The peripheral winter range is generally not used by mature rams.

Ewes begin moving off the winter range to lambing grounds in early June. They move south along the Stillwater River into the lambing grounds along the Flood Creek drainage. Some ewes may lamb at Cathedral Point. During the summer, ewes remain in Flood Creek drainages and also use alpine basins near Two Sisters. They periodically visit old mine roads within the winter range. Fall range resembles summer range.

Rams also move south along the Stillwater River in early June. They travel west from Flood Creek drainages and Wounded Man Creek to the Lake Plateau and Columbine Lake area. Later, the rams move farther west, crossing the East Fork of the Boulder river. Some animals may reach the Hellroaring Creek drainage, over 50 miles from their winter range. Ram fall range is similar to ewe fall range, although rams do not intermingle with the ewes.

TABLE III-6

Post-Hunting Season Counts of the Stillwater Bighorn Population, 1950-1984

Year	Rams	Ewes	Lambs	Lambs per 100 Adult Ewes	Total	Mining Activity in Mouat Area	Source[1]
1950s	8	24	7	29	40[2]	Chrome mining: 1952-61	MDFWP Files
1960s	4	17	5	29	25[2]	Intensive copper-nickel exploration in 1967	MDFWP, USFS Files
1970	2	21	5	24	28	Undocumented	MDFWP Files
1971-72	4	18	11	61	33	"Enough activity to maintain valid mining claims"	Stoneberg (1977)
1972-73	6	22	14	64	42	"Enough activity to maintain valid mining claims"	Stoneberg (1977)
1973-74	7	25	15	60	47	"Enough activity to maintain valid mining claims"	Stoneberg (1977)
1974-75	8	27	11	41	46	"Enough activity to maintain valid mining claims"	Stoneberg (1977)
1975-76	7	28	9	32	44	"Enough activity to maintain valid mining claims"	Stoneberg (1977)
1976-77	11	27	12	48	50	Undocumented	Youmans et al. (1982) Stewart (1984)
1977-78	13	31	16	59	60	Undocumented	Youmans et al. (1982) Stewart (1984)
1978-79	12	25	15	60	52	Undocumented	Youmans et al. (1982) Stewart (1984)
1979-80	17	26	8	33	51	AMC exploration at Mouat mine begins	Youmans et al. (1982) Stewart (1984)
1980-81	14	27	11	46	52	AMC exploration continues	Youmans et al. (1982) Stewart (1984)
1981-82	18	26	11	46	55	AMC exploration continues	Youmans et al. (1982) Stewart (1984)
1982-83	16	20	6	33	42	Maintenance activity[3]	Stewart (1984)
1983-84	23	19	6	33	48	SMC exploration begins	Stewart (1984)

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[1] 1950-1975 data summarized in Stoneberg (1977).

[2] Data is averaged over several years. Therefore, columns 2-4 do not add up to figures in the total column.

[3] Activity limited to caretaking around SMC headquarters (Les Darling, SMC, pers. com., September 12, 1984).

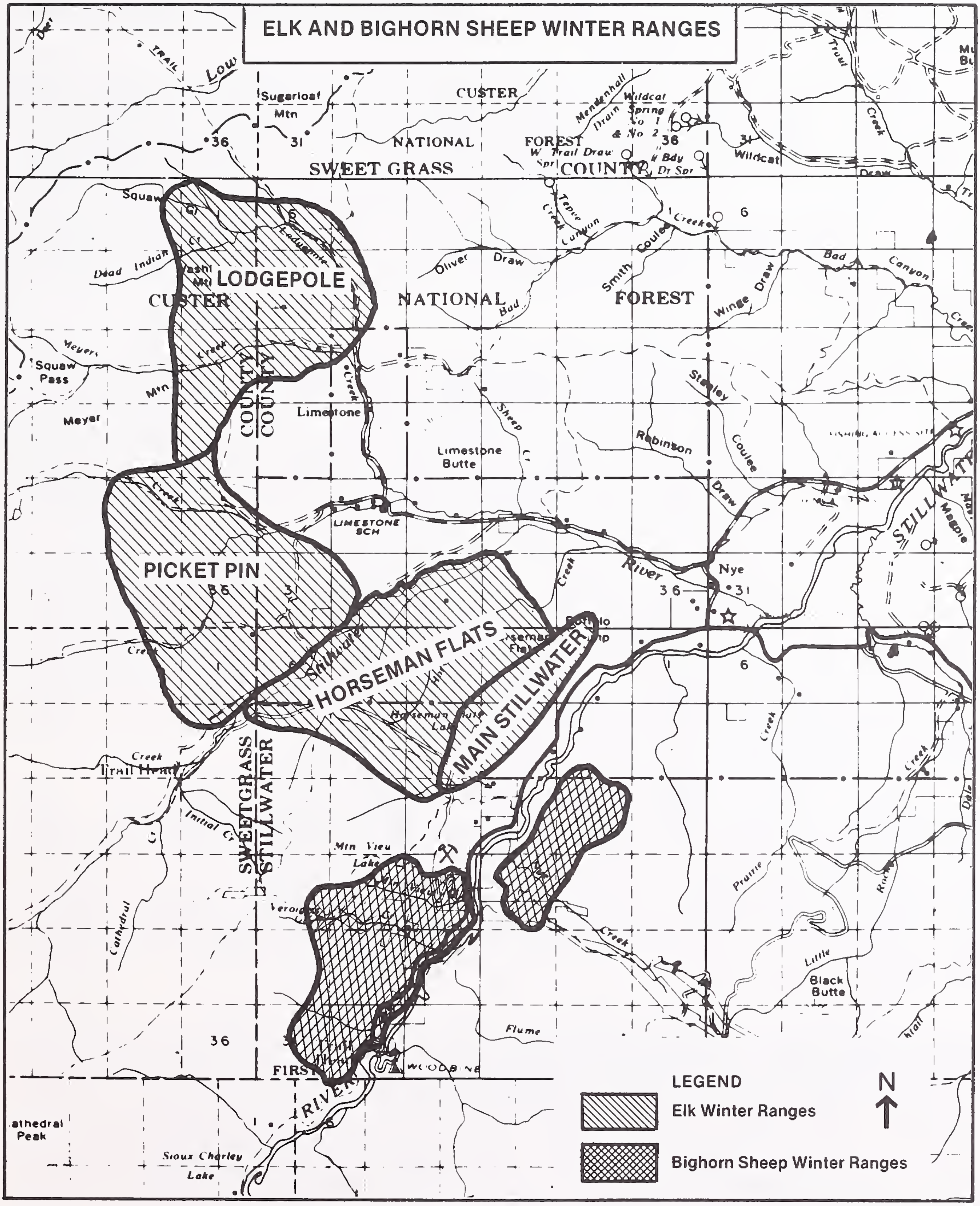


FIGURE III-13

Bighorns use their winter range for eight or nine months, starting in mid-October. All mating takes place on the winter range. Elk in the study area use four winter ranges; none adjoin the project area.

The use of seasonal ranges, travel routes, and lambing grounds is traditional. Knowledge of these areas is gained by young bighorns as they follow older, usually larger-horned, individuals (Geist, 1971).

Winter observations of four collared ewes allows comparison of home range sizes among years (table III-7). Data indicate that three ewes probably increased home ranges in 1979-80. Home ranges of these animals remained large through succeeding winters with the exception of ewe 01, whose movements were limited by injury. One ewe maintained a small range within the escape terrain of a rocky area. The Department of Fish, Wildlife, and Parks (pers. com., August 5, 1982) believes that data in table III-7 represent changes in most of the herd. They suggest that mining-related human activity is responsible for the expanded home ranges of three ewes and the restriction of a fourth ewe to escape terrain.

Winter habitat use by bighorn now differs from patterns observed in 1974-75 (table III-8). The Idaho fescue/bluebunch wheatgrass and skunkbush sumac/bluebunch wheatgrass habitat types (Stewart, 1975) formerly accounted for 50 percent of observations. The Idaho fescue/bluebunch wheatgrass type produces the highest quality forage (Stewart, 1975). By 1983-84, use of this type and the skunkbush sumac/bluebunch wheatgrass type had declined to 21 percent. Youmans et al. (1982) state that bighorn are responding to increased vehicle traffic by avoiding favorable foraging areas near the highway.

Observations made by CDM (1981) in 1980-81 present a different picture of habitat use. During ground surveys (1,190 observations), the drainage bottom meadow type was used year-round by over 60 percent of the bighorns. Sample size was smaller for aerial surveys (80 animals observed), which revealed that stony grasslands were often used (63 percent of spring/summer and 34 percent of fall/winter observations). CDM indicates that stony grasslands are roughly equivalent to Stewart's (1975) Idaho fescue/bluebunch wheatgrass type. Other important bighorn habitats were cliffs and open forests.

Between 1971 and 1982, an average of 12 lambs per year were born. (The average has declined to 10 due to low 1983 and 1984 production; see table III-7). About 59 percent of lambs died during their first year. Mortality rates averaged 12 percent for two- to four-year-old ewes and 27 percent for ewes five to nine years old. Few ewes live past ten years. Hunting controls ram mortality. Before a quota system was implemented, most rams were harvested at three years of age and none lived past five years. Rams now may live to over eight years old.

The Stillwater bighorn herd exists in conditions similar to those of inbred populations. Inbred herds are often small, isolated populations with reduced numbers of breeding males. They are adapted to a narrow set of environmental conditions due to low genetic diversity. Stillwater rams exhibit relatively small horn sizes (Stewart and Butts, 1982) and lamb crops have declined since 1982 (Stewart, 1984). Inbreeding has been noted as a limiting factor in horn growth (Stewart and Butts, 1982) and herd productivity (Farnsworth, 1978, in Skiba and Schmidt, 1982).

TABLE III-7

Home Range Sizes for Four Bighorn Ewes During Winters, 1976 through 1982 (square miles)

Ewe Number		1976-77 (Mild)[1]	1977-78 (Moderate)	1978-79 (Severe)	1979-80 (Mild)	1980-81 (Mild)	1981-82 (Moderate)
01[2]	Home Range Size (mi.^{2})	0.02	0.28	0.16	0.64	0.21	--
	No. of Observations	4	8	15	14	7	0
02	Home Range Size (mi.^{2})	--	0.01	0.17	0.89	0.65	0.58
	No. of Observations	0	5	16	16	21	17
59	Home Range Size (mi.^{2})	0.32	0.19	0.91	0.26	0.13	0.30
	No. of Observations	9	8	14	15	9	12
66	Home Range Size (mi.^{2})	0.20	0.11	0.16	1.10	1.57	0.50
	No. of Observations	8	8	16	14	24	18

[1] General weather conditions.

[2] Ewe 01 was injured during 1980-81 and was dead by 1981-82.

TABLE III-8

Habitat Use by Bighorn During Winter 1974-75 to 1983-84

	Percent Observed in Habitat Type								
Year	FEID/ AGSP	RHTR/ AGSP	ARTR/ AGSP	PSME/ AGSP	PSME/ FEIS	Rock	Misc.[2]	Other[3]	Sample Size[4]
1974-75	33	17	8	4	1	10	0	27	4,362
1980-81	19	8	2	2	2	5	1	61	1,612
1981-82	9	8	Tr.[5]	4	Tr.[5]	2	4	72	2,035
1982-83	13	2	0	3	1	9	1	71	546
1983-84	12	9	1	8	0	4	-	65	336

[1] Habitat types after Stewart (1975). Codes: FEID/AGSP = Idaho fescue/bluebunch wheatgrass, RHTR/AGSP = Skunkbush sumac/bluebunch wheatgrass, ARTR/AGSP = Big sagebrush/bluebunch wheatgrass, PSME/AGSP = Douglas-fir/bluebunch wheatgrass, and PSME/FEIS = Douglas-fir/Idaho fescue.

[2] Includes river bottom and reclamation area.

[3] Calculated by subtracting observed bighorn from estimated total population.

[4] Based on population estimate; includes bighorn not observed.

[5] Less than 1 percent.

Elk

Indications of elk use in the upper Stillwater Valley area date back to the early 1900s. A small group of elk used the Horseman Flats and areas to the west from the late 1940s to the 1960s. This herd increased substantially in the late 1960s. The increase is apparently continuing during the 1980s. The highest winter herd counts were 86 in 1981 and 104 in 1982.

Stoneberg (1977) identified three elk winter ranges: Stillwater, Horseman Flats, and Picket Pin (fig. III-13). He located calving areas along Rabbit Gulch and Horsehead Draw within the Horseman Flats unit. Another calving area is in the Bear Creek-Swamp Creek vicinity within the Picket Pin unit. Youmans et al. (1982) identified an additional winter range north of the Picket Pin unit and centered near the Meyers Creek Ranger Station. Few observations were made on this range, the Lodgepole unit, until 1980. Development of the Lodgepole winter range and declining use of the Horseman Flats and Stillwater units suggest that elk are shifting their winter distribution to the north. Elk travel to summer ranges as distant as the Breakneck Plateau and Placer Basin during May through July. Movement back to winter ranges begins in October and November.

Other Big Game Species

Other large mammals were not intensively studied. Most information is based on incidental sightings made during other wildlife investigations.

(1) Black Bear. Seven bears used southeast-facing slopes between the Beartooth and Stratton ranches during spring 1981. An additional 13 bears were located in drainages near the Meyers Creek Ranger Station.

(2) Moose. Little information on moose is available. Recent observations have been limited to one animal at the Woodbine Trailhead and a small group along Fishtail Creek. Moose populations in the Stillwater Valley were apparently greater prior to the 1950s. Current moose range lies southeast of the wildlife study areas.

(3) Mountain Goat. A mountain goat herd was introduced and established south of Woodbine Campground. One goat was repeatedly sighted on cliffs east of the Stillwater River at the southern end of CDM's study area. The closest group of goats came within 3 miles of the study area's southern boundary.

(4) Mountain Lion. Two mountain lions were observed in separate observations in the fall of 1980. In January 1981 on adult female and one young lion were sighted feeding in a Douglas-fir forest.

Small and Medium-Sized Mammals

Small and medium-sized mammals are important prey for raptors and mammalian predators. Eleven species of rodents were trapped; however, 90 percent of the captures were deer mice, which were captured in all habitats. Other common species included the Gapper's red-backed and long-tailed vole and the yellow-pine chipmunk (table III-9). Also trapped were the water vole, the least chipmunk, the bushy-tailed woodrat, and three species of shrews.

The twelve species of medium-sized mammals observed were beaver, muskrat, porcupine, nuttall's cottontail, snowshoe hare, white-tailed jackrabbit, raccoon, long-tailed weasel, mink, striped skunk, and coyote. bobcat tracks were seen on river banks.

Raptors (Birds of Prey)

Thirteen raptorial species were observed in addition to the peregrine falcon and bald eagle (see Threatened and Endangered Species). The most common year-round resident sighted was the golden eagle. Most observations were in stony grasslands and on rocky cliffs. An active eagle nest was located near Stillwater Mining Company's headquarters. During 1980, a single fledgling was produced. The nest has apparently not been active since (Les Darling, Stillwater Mining Company, pers. com., September 14, 1984).

The northern harrier, red-tailed hawk, and American kestrel are common summer residents of the study area. Rough-legged hawks are the most common winter resident; prairie falcons are also present.

TABLE III-9

Observed and Expected Numbers of Common Small Mammals Trapped in the Stillwater Study Area

	Deer Mouse		Gapper's Red-backed Vole		Yellow-pine Chipmunk		Long-tailed Vole	
Habitat	Obs.[a]	Exp.[b]	Obs.[a]	Exp.[b]	Obs.[a]	Exp.[b]	Obs.[a]	Exp.[b]
Boulder & Talus, Rock Cliffs/Benches	409	118	0	3.7	0	1.6	0	1.7
Forest	625	1,035	49	32.1	14	13.7	11	14.8
Shrubland	222	83	0	2.6	0	1.1	4	1.2
Grassland/Meadow	207	529	0	16.4	2	7.0	0	7.5
Disturbed/Cultivated	404	148	11	4.6	22	2.0	0	2.1
Riparian/Palustrine	166	104	3	3.2	0	1.4	14	1.5
TOTAL	2,033	2,017	63	62.6	27	26.8	29	28.8

Note: To increase sample size, habitat types have been grouped according to the main structural component of each type.

[a] Obs.=Observed number of animals captured per 100 trap-nights.

[b] Exp.=Expected number of animals captured based on proportion of total area occupied by each habitat type and total observed captures.

Songbirds

Ninety-two species of songbirds were observed during the one-year study period (1980-81). Riparian woodlands and open Douglas-fir forest supported both a large number of species and total birds. Stony grasslands were used by few species, although western meadowlarks, vesper sparrows, and mourning doves were occasionally numerous.

Gamebirds and Waterfowl

Fifty-one observations of blue grouse were made during baseline inventories. Most blue grouse were sighted in open forested habitats. The steep, forested slopes west of the proposed mine accounted for several observations. Ruffed grouse were observed on 27 occasions. Most were sighted in ravine aspen or riparian woodland habitats. Gray partridge are present, but uncommon, in the study area. Their habitat is suboptimal due to insufficient amounts of cultivated lands.

Even during spring and fall migration periods, waterfowl use of the study area is limited. Scattered observations were made on the Stillwater River or stock ponds. Mallards were the most abundant species.

Reptiles and Amphibians

Red-sided garter snakes, wandering garter snakes, yellow-bellied racers, prairie rattlesnakes, and bullsnakes, although uncommonly observed, used a variety of habitats. One Rocky Mountain rubber boa was observed. Six observations of leopard frogs, all near water, were made.

THREATENED AND ENDANGERED SPECIES

The U.S. Fish and Wildlife Service, on September 8, 1981, provided the U.S. Forest Service with a list of endangered species that could occur in the project area. The list included the peregrine falcon and bald eagle. Biological assessments were prepared by the Forest Service (U.S. Department of Agriculture 1982, 1984, and 1985) for the peregrine falcon and bald eagle. These assessments were used for preparing the threatened and endangered species sections. After reviewing the biological assessments, the U.S. Fish and Wildlife Service, on July 1, 1985, determined that the Stillwater project (the proposal) would be unlikely to jeopardize the continued existence of the peregrine falcon or the bald eagle.

Peregrine Falcon

Peregrine falcons are known to have nested within the study area. One cliff complex in particular is identified as the most suitable nest site of the study area (USFS, 1984). The cliff complex was occupied in 1975-76, with an unconfirmed sighting reported as late as 1980. An immature bird was seen during the 1980-81 survey period, but no active pairs were found. There appears to be additional nesting habitat available downstream from the study area.

The riparian and mosaic habitats close to the cliff and along the length of the river provide excellent hunting habitat for peregrines. Nongame bird transects have documented the presence of preferred prey items.

Bald Eagle

Bald eagles are present in the study area during fall and early winter (October-December) and winter/spring periods (February-March). This seasonal use appears to occur regularly, although mid-winter use is probably low and sporadic. Riparian woodland and open habitats within the study area are important for feeding, roosting, and perching. There is no documented nesting of bald eagles in the Stillwater River drainage, although suitable habitat exists in the study area. The number of bald eagles using the area varies. Between August and December 1980 twelve bald eagles were observed in the study area. In 1981, as many as seven bald eagles were observed at one time using the cottonwood woodlands along the Stillwater River.

CLIMATE

The region containing the project area has a mountainous continental climate, owing to its location in the mountains far from large bodies of water. This type of climate is characterized by large daily and annual temperature ranges and marked differences in precipitation, temperature, and wind patterns over distances of only a few miles.

Thirty-year climatological normals are not available for the immediate area. The data presented in fig. III-14 are from Red Lodge, located 35 miles southeast of the minesite.

Precipitation

Average annual precipitation is 23.2 inches. Over 53 percent of this falls during March through June. About 3.5 inches fall monthly during April, May, and June. However, the greatest amount of effective precipitation--water available for soil formation and erosion--falls during March and April (fig. III-14). The percentage of total precipitation occurring as snow increases with elevation. Below 5,000 feet snow accounts for 15 to 20 percent of the total, while above 9,000 feet snow sometimes accounts for as much as 90 percent.

Severe weather in the Stillwater River Valley is uncommon. Heavy thunderstorms occasionally take place in July and August and less frequently in June and September. There is a 20 percent chance a one-inch rainfall will occur in one hour in any given year, whereas a three-inch total in 24 hours

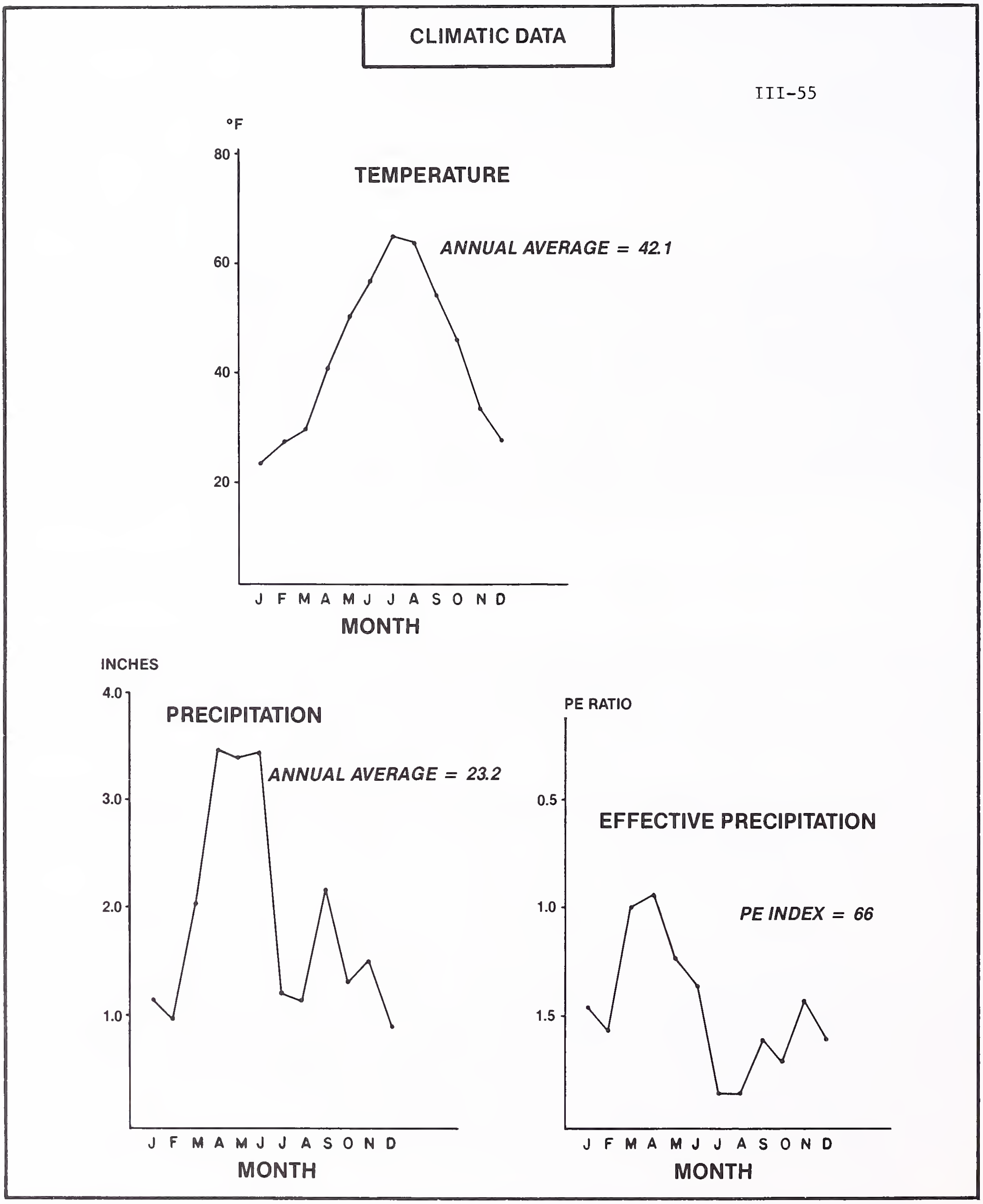


FIGURE III-14

Data from Red Lodge, Montana, from 1931 to 1960 show that temperature, precipitation and effective precipitation vary sharply with the season. Precipitation is heaviest in April, May, and June. January is the coldest month, July the hottest.

could be expected one year in ten (table III-10). Hailstorms also occur infrequently.

TABLE III-10

Size of Largest Storm that can be Expected at the Project Area During Various Lengths of Time

	Interval in Years					
	2	5	10	25	50	100
Length of Event	Size of Largest Storm (Inches)					
1 hour	0.7	1.0	1.2	1.5	1.7	1.9
6 hours	1.2	1.6	1.8	2.2	2.4	2.8
24 hours	2.0	2.8	3.0	3.4	3.8	4.2

Source: Miller et al., 1973.

Temperature

The annual average temperature is about 42°F and decreases with increasing elevation. At 10,000 feet, the average is estimated to be about 30°F. The warmest months are July and August and the coldest is January. At lower elevations the first freezing temperature in autumn normally occurs in mid-September and the last occurs in mid-June. At elevations above 7,500 feet, freezing temperatures may occur at any time.

Winds

Wind speed and direction were measured at the minesite and the Hertzler Ranch site from September 1, 1980, through August 31, 1981. Prevailings winds are from the southwest to the northwest throughout the year. The average wind speed was 10 miles per hour (mph) at the minesite and 7.4 mph at the Hertzler Ranch site. Only during August was the month's average wind speed lower at the minesite than at the Hertzler Ranch site. Maximum hourly wind speeds were usually greater at the minesite (figs. III-15 and III-16). During January 11-12, 1981, the wind speed at the minesite exceeded 29 mph for 29 consecutive hours.

AIR QUALITY

The air quality at the Stillwater Project area is excellent. For the monitoring period of August 1980 through July 1981, annual average total suspended particulate (TSP) concentrations were 9.6 $\mu g/m^3$ (micrograms per cubic

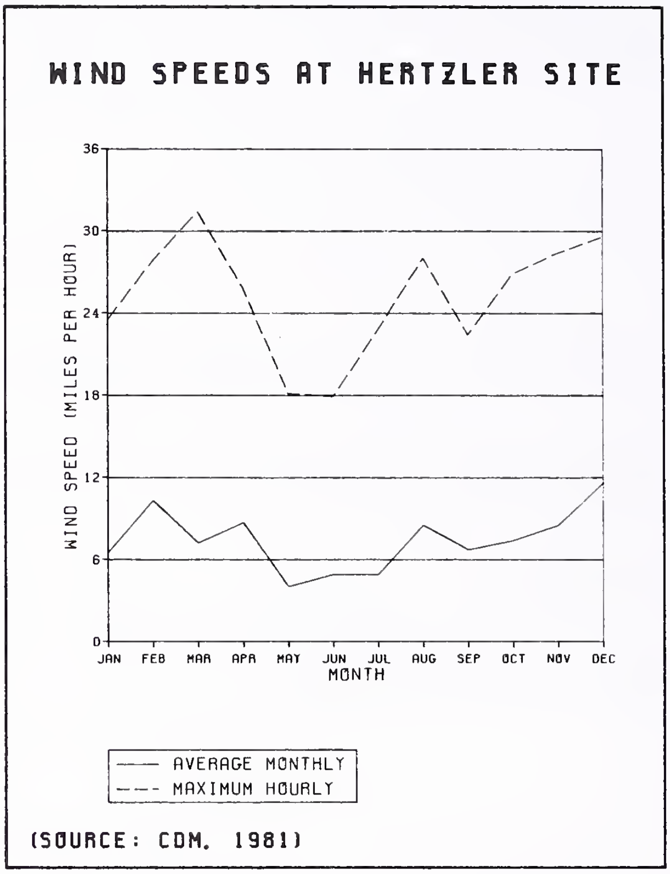


FIGURE III-15

The average wind speed at the Hertzler site is about 7 miles per hour. Winds from the southwest to northwest prevail.

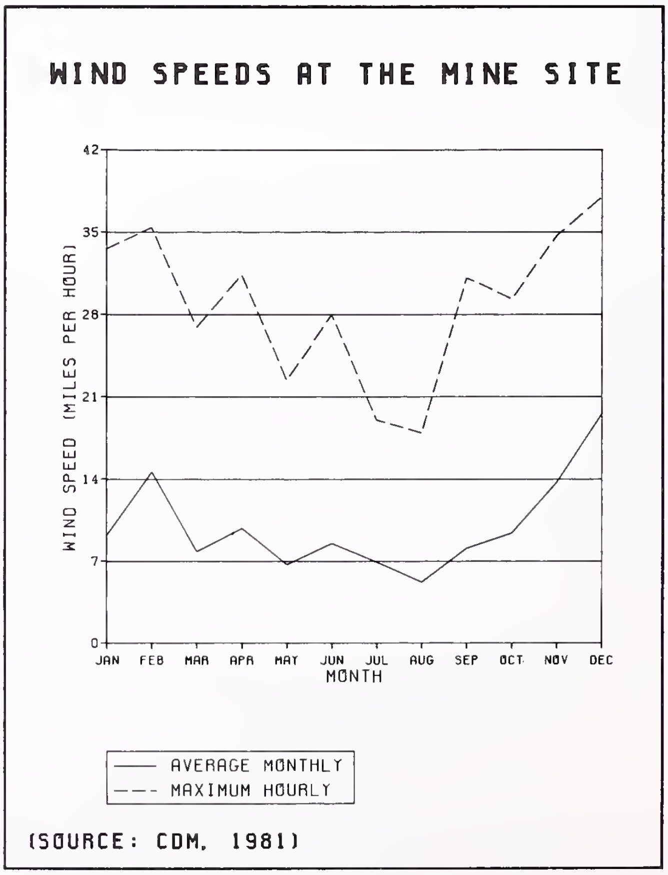


FIGURE III-16

Wind speeds at the minesite, averaging about 10 miles per hour, are slightly higher than at the Hertzler site. Hourly maximum speeds occasionally exceed 35 miles per hour.

meter) at the Beartooth Ranch site, 14.0 $\mu g/m^3$ at the minesite and 17.6 $\mu g/m^3$ at the Hertzler Ranch site. The maximum 24-hour TSP concentrations, recorded in August 1981, were 43 $\mu g/m^3$ at the Beartooth Ranch site, 41 $\mu g/m^3$ at the minesite, and 89 $\mu g/m^3$ at the Hertzler site. These concentrations are well below both federal and Montana ambient air quality standards (table III-11). Sulfate and lead concentrations measured at the minesite were also low: Lead concentrations averaged 0.002 $\mu g/m^3$; sulfate concentrations averaged 2.2 $\mu g/m^3$.

The major sources of TSP in the area are probably vehicle traffic and wind erosion. Thus, during the winter when road surfaces are frozen and disturbed areas are snow covered, the TSP concentrations are lowest (fig. III-17). The entire area is classified as a Class II airshed, including the Absaroka-Beartooth Wilderness.

There are no major pollution sources in the area, so all other pollutants are present in only very low concentrations.

EMPLOYMENT AND INCOME

Employment

Despite the 9-percent decline in employment during the 1970s (table III-12), a loss of 63 basic industry jobs, agriculture remained the leading employer in Stillwater County. An increase in manufacturing employment of 50 jobs partially made up for the decline in basic industry employment. Led by increases in the derivative sector industries of trade, services, and nonfarm proprietors, total employment in the county rose from 1,782 jobs to 2,107 jobs, an average annual rate of 1.9 percent. The increase during the 1970s was a reversal of the trend of the preceding 20 years.

Fifty-three percent of county heads of households are employed, 2 percent are unemployed, and the remaining 45 percent are retired or are housewives (Entercom, 1981, p. 829). Unemployment in the county has generally run at a rate significantly below the statewide rate from 1970 to 1981 (table III-13). However, in recent years the county unemployment rate has risen to a level equal to and above the state unemployment rate. As of March 1984 the county unemployment rate was 13.1 percent, compared to the statewide average of 9.7 percent (Montana Department of Labor and Industry, 1st Quarter 1984, p. 11).

Because of the increasing number of county residents who commute to jobs outside the county, the number of employed persons grew at a rate faster than the rate of employment growth, particularly during the second half of the 1970s. From 1970 to 1979, the number of employed persons increased from 1,699 to 2,188 (table III-13), or at an average annual rate of 2.5 percent. The growth rate was higher from 1975 to 1979, increasing at an average annual rate of 4.3 percent, compared to the 1.6 percent rate from 1970 to 1975. In recent years, the number of employed persons has decreased from a high of 2,497 in 1980 to 1,945 in 1982. Such a decline represents an annual average rate of 7.9 percent.

TABLE III-11

Ambient Air Quality Standards (AAQS)

Pollutant	Averaging Time	Montana	Primary[a]	Secondary[b]
Total Suspended Particulate	Annual	75μg/m^3 [b]	75μg/m^3	60μg/m^3
	24 Hours	200μg/m^3 [f]	260μg/m^3	150μg/m^3
Sulfur Dioxide	1 Hour	0.50ppm[e]	---[h]	---
	3 Hours	---	---	0.5ppm
	24 Hours	0.10ppm[d]	0.14ppm	---
	Annual	0.02ppm[f]	0.03ppm[f]	---
Carbon Monoxide	1 Hour	23ppm[4]	35ppm	35ppm
	8 Hours	9ppm[4]	9ppm	9ppm
Lead	90 Days	1.5μg/m^3 [f]	1.5μg/m^3	1.5μg/m^3
Nitrogen Dioxide	1 Hour	0.30ppm[d]		
	Annual	0.05ppm[f]	0.05ppm[f]	0.05ppm[f]
Settled Particulate	30 Days	10g/m^2 [f]	---	---
Nonmethane Hydrocarbons[g]	3 Hours (6-9 a.m.)	---	0.24ppm	0.24ppm
Photochemical Oxidants (ozone)	1 Hour	0.10ppm[d]	0.12ppm	0.12ppm

[a] Federal ambient air quality standards with averaging time less than 1 year are not to be exceeded more than once per year.

[b] Arithmetic average; not to be exceeded.

[c] Geometric mean; not to be exceeded.

[d] Not to be exceeded more than once per year.

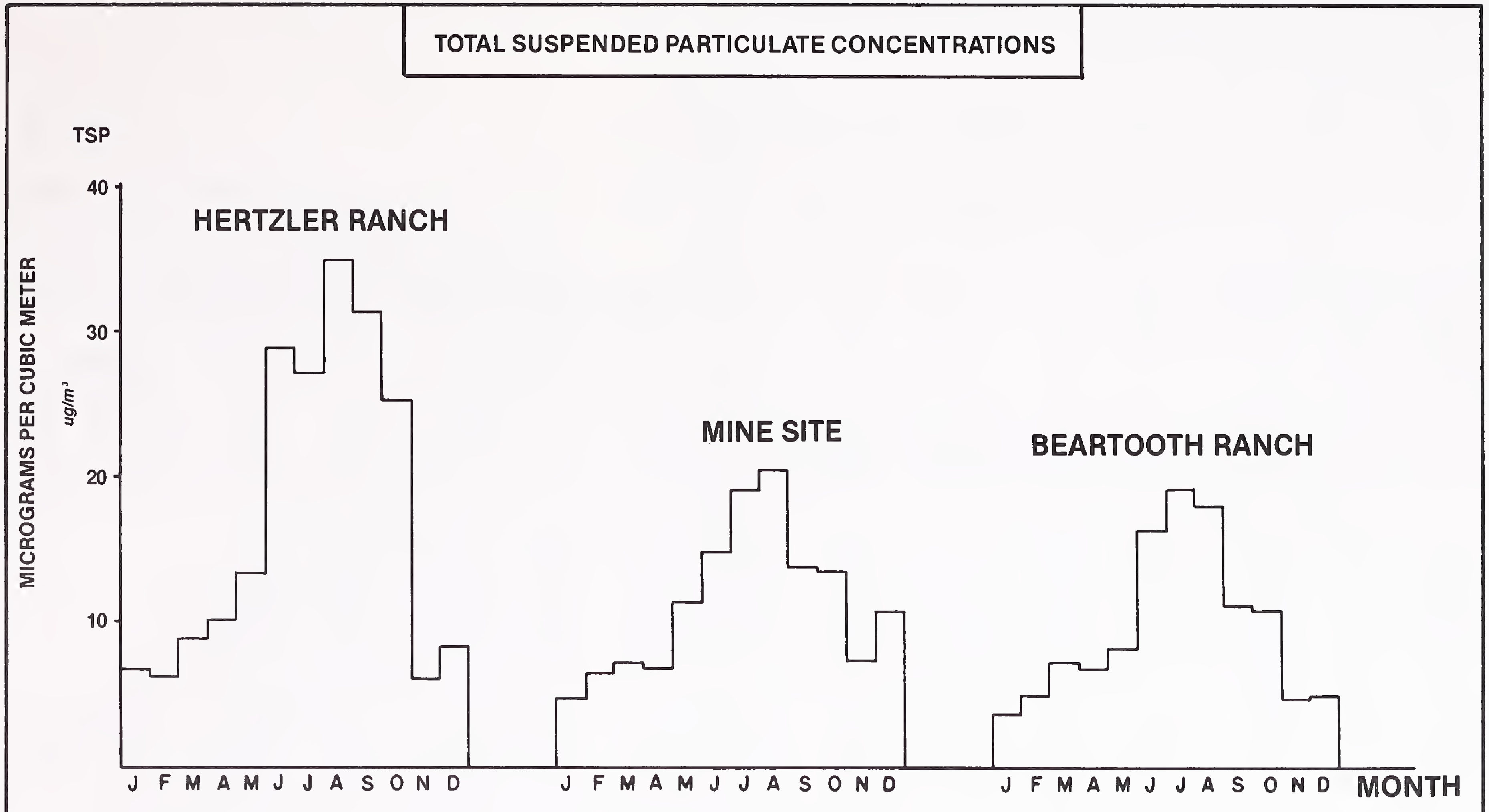
[e] Not to be exceeded more than 18 times in any 12 consecutive months.

[f] Not to be exceeded.

[g] Set as a guide to achieve photochemical oxidant standards.

[h] ---indicates no standard.

Twenty-three percent of the persons employed in Stillwater County commute to jobs outside the county (Entercom, 1981, p. 916); another 11 percent work both inside and outside the county. Intercounty commuters earned higher salaries than persons employed only inside the county: The 26 percent of the



	HERTZLER RANCH	MINE SITE	BEARTOOTH RANCH
NUMBER OF SAMPLES	114	111	104
ANNUAL AVERAGE (ug/m³)	17.6	11.4	9.6
GEOMETRIC MEAN (ug/m³)	12.2	9.4	7.6
FIRST MAXIMUM[1] (ug/m³)	89	41	43
SECOND MAXIMUM[1] (ug/m³)	74	37	27

FIGURE III-17

Air quality at all three monitoring sites--Hertzler Ranch, the minesite, and Beartooth Ranch--is excellent. Total suspended particulate concentrations are well below both state and federal limits.

TABLE III-12

Employment by Major Industry in Stillwater County 1970-79

	1970[a]	1971[a]	1972[a]	1973[a]	1974[a]	1975[a]	1976[a]	1977[a]	1978[a]	1979[a]	1980	1981	1982
Agriculture[1]	677	689	693	688	710	677	602	601	604	634	625	625	636
Mining	(D)	(D)	(L)	(D)	(D)	(D)	(L)	(L)	(L)	(D)	(D)	(D)	(D)
Construction	23	29	31	32	31	21	36	50	56	50	55	81	46
Manufacturing	64	77	90	114	123	133	115	99	107	114	108	133	130
T.U.[2]	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	79	81	70	73
Trade	178	201	195	206	206	195	214	220	236	266	279	263	266
F.I.R.E.[3]	38	40	45	45	45	42	39	44	47	55	55	54	53
Services	(D)	(D)	(D)	126	142	152	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Nonfarm proprietors	261	229	246	270	294	297	307	345	375	371	384	391	402
Federal government	71	71	75	66	71	69	67	60	63	63	64	55	54
State and Local government	217	226	231	233	243	251	253	257	266	268	264	257	265
TOTAL	1,722	1,789	1,850	1,875	1,972	1,952	1,971	1,995	2,076	2,172	2,211	2,220	2,170

Sources: U.S. Department of Commerce, 1980a, 1981a.

[a] Estimated based on 1967 Standard Industrial Codes.

[b] Estimates based on 1972 Standard Industrial Codes.

[1] Includes: farm proprietors, farm wage and salary employment, agricultural services, forestry, fisheries and other.

[2] Transportation and public utilities.

[3] Finance, insurance and real estate.

(D) Not shown to avoid disclosure of confidential data. Data are included in totals.

(L) Less than 10 wage and salary jobs.

TABLE III-13

Stillwater County Employment Statistics 1970-1983

Year	Labor Force	Employment	Unemployment Number	County Rate	Montana Unemployment Rate
1970	1,766	1,699	67	3.8	4.3
1971	1,838	1,733	105	5.7	4.8
1972	1,757	1,673	84	4.8	4.8
1973	1,774	1,699	75	4.2	4.8
1974	1,884	1,815	69	3.7	5.2
1975	1,938	1,843	95	4.9	6.4
1976	2,016	1,920	96	4.8	6.1
1977	1,968	1,864	104	5.3	6.4
1978	2,111	2,019	92	4.4	6.0
1979	2,263	2,188	75	3.3	5.1
1980	2,581	2,497	84	3.3	6.0
1981	2,335	2,241	94	4.0	6.9
1982	2,407	2,201	206	8.6	8.6
1983	2,188	1,945	243	11.1	8.8

Source: Montana Department of Labor and Industry Quarterly Report, 1st Quarter, 1984.

Note: Employment as used here is the number of employed persons by place of residence. This number is different from the Department of Commerce employment figure, which measures the number of jobs by place of work.

residents who worked in jobs outside the county earned more than $24,000 in 1980; 13 percent of the residents who worked only inside the county (Entercom, 1981, p. 940) earned that much. The intercounty commuters have not had as great an effect on the local economy as might be indicated by their greater-than-average earnings, because the members of their households are less likely to shop in Stillwater County than are other county residents. Eighty-one percent of the residents employed inside the county, compared to 39 percent of those employed outside the county, usually shop for everyday items in Stillwater County (Entercom, 1981, p. 582). Most residents in the county shop for major purchases outside the county, but persons working outside the county are even less likely to shop in Stillwater County: 26 percent of those working in the county compared to 8 percent of those outside shop in Columbus (Entercom, 1981, p. 586). Besides having greater opportunity to shop outside the county, intercounty commuters live closer to Billings and so are more likely to shop outside the county. Sixty-two percent of the intercounty commuters live near Park City, 23 percent near Columbus, and 13 percent live near Absarokee (Entercom, 1981, p. 913).

Income

The increasing trend for county residents to hold jobs outside the county is reflected in county personal income statistics. One of the items in the total personal income estimate made by the U.S. Department of Commerce is the "residence adjustment" (table III-14). This item reflects flows of earned income into the county because of intercounty commuters. During the 1970-74 period, only 7 percent of the growth in Stillwater County total personal income was provided by growth in the residence adjustment (U.S. Department of Commerce, 1980b), compared to 34 percent of the 1974-79 growth (U.S. Department of Commerce, 1981b).

Income growth in the county during the 1970s was led by increases in transfer payments, dividends, interest and rent, which provided 57 percent of the growth. These items, which reflect the importance of retired persons to the local economy, made up 43 percent of county total personal income in 1979 (table III-14). Net labor and proprietor's income has been adversely affected by poor earnings in the farm industry in recent years, but still managed to provide 9 percent of income growth during the decade and stood at 42 percent of the total in 1979.

SOCIOLOGY

The Study Area

The sociology study area includes all of Stillwater County (fig. S-1). The southern portion of the county includes 187,850 acres of the Custer National Forest. Columbus is the only incorporated town in the county.

Stillwater County is rural in character; agriculture has been the foundation of the local economy since the area was settled. The largest percentage of workers (28 percent) are employed in farming and ranching (Entercom, 1981). Although the Entercom study included forestry and fishing in the farming category, few county residents are employed in forestry or fishing operations (Mitch Press, Stillwater County Planner, oral com., March 1982).

Previous mineral development and exploration brought a peak population of 1,900 in 1943 to the Nye area for less than three months. The highest number of people employed recently in mineral activity was 41 in the summer of 1981 during the engineering phase of the Anaconda Minerals Company project. The only other energy or mineral development in the county is a minor amount of oil and gas production.

The metropolitan area nearest to Stillwater County is Billings, 41 miles east of Columbus. Seventy-five percent of county residents shop for major items in Billings and 23 percent work outside Stillwater County, most probably in Billings. Columbus is the county trade center: 37 percent of county residents purchase everyday items such as groceries at Columbus; 17 percent also purchase major items, such as cars, furniture and household appliances. Other towns in the county, Absarokee, Fishtail, Beehive, Nye, and Dean, offer

TABLE III-14

Stillwater County Personal Income by Major Source, 1970-83
(thousands of dollars)

ITEM	1970[1]	1972[1]	1973[1]	1974[1]	1975[2]	1976[2]	1977[2]	1978[2]	1979[2]	1980[2]	1981[2]	1982[2]
TOTAL LABOR AND PROPRIETOR'S INCOME BY PLACE OF WORK[3]												
By type												
Wage and salary disbursements		5,969	6,741	7,810	8,429	9,125	9,620	10,386	12,503	15,541	16,684	16,348
Other labor income		305	357	441	543	636	748	747	887	1,081	1,147	1,245
Proprietor's Income[4]		8,569	8,419	8,195	7,261	2,557	2,162	3,857	2,749	1,766	1,968	865
Farm		7,270	7,002	6,706	5,553	797	78	1,607	564	-90	303	-762
Nonfarm[4]		1,299	1,417	1,489	1,708	1,760	2,084	2,250	2,185	1,856	1,665	1,627
By industry												
Farm		8,366	8,339	8,323	7,038	2,165	1,492	3,095	2,438	2,683	2,934	2,286
Nonfarm		6,477	7,178	8,123	9,195	10,153	11,038	11,895	13,701	15,705	16,865	16,172
Private		4,912	5,470	6,221	7,016	7,765	8,418	9,036	10,549	12,245	13,121	12,126
Government		1,565	1,708	1,902	2,179	2,388	2,620	2,859	3,152	3,460	3,744	4,046
DERIVATION OF PERSONAL INCOME BY PLACE OF RESIDENCE												
Total labor and proprietor's income by place of work		14,843	15,517	16,446	16,233	12,318	12,530	14,990	16,139	18,388	19,799	18,458
Less: personal contributions for social insurance by place of work		427	518	569	643	730	804	874	1,043	1,155	1,345	1,348
Net labor and proprietor's income by place of work		14,416	14,999	15,877	15,590	11,588	11,726	14,116	15,096	17,233	18,454	17,110
Plus: residence adjustment		1,055	1,182	1,350	1,487	1,702	3,511	5,147	5,821	6,123	6,895	7,532
Net labor and proprietor's income by place of residence		15,471	16,181	17,227	17,077	13,290	15,237	19,263	20,917	23,356	25,349	24,642
Plus: dividends, interest, and rent[5]		4,131	4,719	5,898	6,081	6,736	7,329	8,621	10,244	12,563	16,021	17,160
Plus: transfer payments		2,296	2,682	3,163	3,720	4,205	4,722	5,163	5,871	6,900	8,193	9,672
Personal income by place of residence		21,898	23,582	26,288	26,878	24,231	27,288	33,047	37,032	42,819	49,563	51,474

Sources: U.S. Department of Commerce, 1980b, 1981b.

[1] Estimates based on 1967 Standard Industrial Codes.
[2] Estimates based on 1972 Standard Industrial Codes.
[3] Consists of wage and salary disbursements, other labor income and proprietor's income. Primary source for private nonfarm wages: FR 202 covered wages, Montana Employment Security Commission.
[4] Includes the capital consumption adjustment for nonfarm proprietors.
[5] Includes the capital consumption adjustment for rental income of persons.

limited shopping. Park City serves as a bedroom community for Billings commuters: 60 percent of the residents in the Park City census division work outside the county (Entercom, 1981, p. 913).

The proximity of the study area to the Billings metropolitan area has resulted in an increase in Stillwater County of (1) part-time residents who have built or purchased second homes for recreational purposes or for retirement; (2) through traffic by city residents on their way to Custer National Forest or the Absaroka-Beartooth Wilderness; and (3) suburban development in the communities closest to Billings (Camp Dresser and McKee [CDM], May 1981, p. 2.10-86).

Methodology

A survey was conducted in 1981 by Entercom, a research firm, to gain information on the employment, recreational activities, attitudes, and demographic characteristics of Stillwater County residents. Three hundred eighty-two interviews were completed from a total of 3,139 households in the county. Households were selected using a systematic random sample that gave each household an equal chance of being selected. The adult in each household selected for an interview was also chosen by a method that gave each adult in the household an equal opportunity of being selected. Except where noted, the data in the remainder of this section come from the Entercom survey. The results of this survey are statistically accurate to within 5 percent at a 95 percent confidence level. Simply stated, if a sample of households were selected 100 times, 95 times out of the 100 the result obtained would not vary more than 5 percent from the results that would be obtained if all households in the county were interviewed (Entercom, 1981).

The Entercom survey was conducted as part of the background information for the proposed Anaconda Minerals Company project. Increased levels of unemployment in Stillwater County may have since affected some residents' attitudes.

Demography

The county has no distinctive ethnic or cultural characteristics. Ninety-nine percent of 1980 county residents were white (U.S. Dept. of Commerce, 1981d).

The 1980 county population was 5,598, up 21 percent over the 1970 figure (U.S. Department of Commerce, 1981c), following a downward trend since 1920 (Montana Department of Community Affairs, 1975). Much of the recent growth has occurred in or near Park City, which has experienced a 49 percent growth in population.

The county has a high proportion of people 65 years and older--31 percent of the residents. Another 16 percent are between 55 and 64. The age categories 18 to 34 and 35 to 54 each accounted for 26 percent of the residents. In Absarokee, 60 percent of the households had members over 64; another 13 percent had members between 55 and 64.

Seventy-one percent of those surveyed are married and 16 percent are widowed. The average size of the households was 2.6. The largest proportion of households, 38 percent, have two people. Twenty-seven percent have four or more persons; 20 percent are single-person households; and 15 percent are three-person households.

The largest proportion of residents, 19 percent, earned between $16,000 and $24,000 in 1980. Of the remaining residents, 11 percent earned between $24,000 and $32,000; 10 percent earned between $4,000 and $8,000; 8 percent between $32,000 and $40,000; 8 percent less than $4,000; and 6 percent over $40,000. The remaining 15 percent did not respond. Twenty-three percent of employed persons work outside the county and 11 percent work both in Stillwater County and outside.

Twenty percent of those surveyed had attended some college; another 13 percent graduated from college, and 6 percent (about half of all college graduates) did postgraduate work. The largest proportion, 41 percent, were high school graduates. Twenty-six percent had not completed high school.

Thirty-five percent of the 1981 county population surveyed moved to the county within the last 10 years. By census divisions, this influx was true of 55 percent of Park City residents, 40 percent of the Columbus division residents, 29 percent of the Columbus town division residents, 32 percent of the Absarokee division residents, and 18 percent of the Stillwater north division residents.

Occupational Structure

Of the employed residents, 30 percent work in technical, clerical, sales, administrative or support occupations; 25 percent in farming, forestry, or fishing; 13 percent in managerial or professional specialty occupations; 12 percent in operations, manufacturing, or labor; 11 percent in precision production, craft or repair occupations; and 10 percent in service occupations.

Forty-eight percent of those employed work for a private company, business, or individual. Twenty-seven percent are self-employed in business, professional practice, or ranching. Twenty-five percent work for government agencies or other organizations.

Values

According to Gold (1976), the people in Stillwater County generally value their current lifestyle because it is simple, is not stressful, and gives them a sense of permanence.

Current Stillwater County residents chose to live there, according to those surveyed, for a number of reasons: 17 percent cited a farm, a ranch, a cabin, land or a business; 13 percent cited the desire to be near relatives; 11 percent stated the desire to be in a small community with peace and quiet; 11 percent noted job opportunities; and 10 percent liked the beauty of the area. Additional reasons were given by less than 10 percent of the respondents.

Twenty-eight percent of residents surveyed stated that they must have either their family, a good relationship with their family, their family nearby, or be able to raise a good family to ensure a happy and satisfying life. Other attributes of a happy life mentioned were good health (listed by 16 percent of those surveyed); adequate income (listed by 20 percent); a good job (listed by 14 percent); friends (listed by 10 percent); and recreation or a hobby (listed by 10 percent). Other needs were listed by fewer than 10 percent of those surveyed.

Eighty-four percent of the households own their home or are purchasing it. Such levels of home ownership indicate a commitment to the area by a large majority of the households.

Attitudes and Concerns

Residents surveyed feel they now can have effective involvement in matters affecting their community; however, they are split as to whether or not there are adequate controls to ensure that individual interests are protected when in conflict with those of large corporations.

Directly relevant to the mine development issue are residents' perceptions of regulatory control of mining and reclamation efforts. While most residents feel that effective control is possible, a substantial minority (28 percent) do not.

Eighty percent of the survey respondents said they had heard or read something about a proposed mining operation in the county. In Absarokee, 91 percent were aware of the proposed mine, while in the northern portion of the county only 55 percent were aware of it.

Three primary advantages to development of the Anaconda project (and presumably to the Stillwater Mining Company project) were seen by the residents surveyed: (1) job opportunities, mentioned by almost two thirds; (2) a boost to the area's economy, mentioned by nearly half; and (3) a broader tax base for the county, mentioned by 29 percent. Other advantages mentioned by 10 percent or fewer individuals included population growth, better school system, better roads, development of domestic rather than importing foreign minerals, and improvement of the housing industry. Four percent did not see any advantages to the residents of Stillwater County.

Despite these advantages, those surveyed listed more disadvantages. Three themes underlay the nine most mentioned disadvantages. The first theme, population influx, was mentioned by 30 percent of the respondents as the main disadvantage. The residents fear that development would bring too many people into the area too quickly and that many of the in-migrants would be transient or undesirable, thereby increasing crime. Many residents felt there would be rapid social change and social problems.

The second theme, overburdening of the county public service system, was mentioned by 29 percent as the main disadvantage of the project. Of specific concern were the burdens on schools, roads, law enforcement, water supply and sewer systems, medical care, and fire protection. The third theme, environmental problems which could be caused by development, including air, water and noise pollution, loss of wilderness, loss of wildlife, and scarring of the land, was mentioned by 20 percent as the main disadvantage.

Other concerns mentioned, but by fewer than 10 percent were additional tax burdens on county residents following the population decline after mining; hardship for ranchers; increased living costs; and creation of a boom town. Eight percent felt there would be no disadvantages to county residents.

The residents surveyed clearly believed that job opportunities, local economic stability, and, to a lesser extent, shopping facilities, medical and mental health facilities, and cultural opportunities would be improved by development of the project. The residents also clearly felt that air, water and scenic quality, housing costs and availability, ranching and farming, and friendliness and concern of neighbors would be adversely affected.

COMMUNITY SERVICES

The part of Montana most likely to be affected by the Stillwater Project, and therefore the area analyzed here, is Stillwater County. The demand on future services projected below would occur even without the addition of the proposed project.

Schools

Columbus

The 1984 Columbus elementary school enrollment was 295 (Stillwater Mining Company, 1984b, p. 46). Sixteen classrooms and 18 teachers serve kindergarten through eighth grade providing one classroom per 18 students and one teacher per 16.5 students. Elementary school enrollment is projected to increase from 6 to 10 students per year without the Stillwater Project (Stillwater Mining Company, 1984b, p. 46). Future Columbus elementary school enrollment could surpass Montana school accreditation standards, depending on the age distribution of students. The Columbus elementary school needs expansion; a bond issue was approved but not sold (Briscoe, Maphis, Murray, Lamont, Inc. [BMML], 1981).

The 1984 enrollment for Columbus High School was 150 students (Stillwater Mining Company, 1984b, p. 52). The school has 13 teachers and 13 classrooms for an average of one each per 11 students. Baseline enrollment will increase approximately 3 to 5 students annually over the next 5 to 6 years (Stillwater Mining Company, 1984b, p. 52).

Absarokee

Enrollment in the Absarokee elementary school was 188 students in 1984 (Stillwater Mining Company, 1984b, p. 33). Approximately 30 of these students are from the Nye and Fishtail school districts. The elementary school has 12 teachers, 10 classrooms, and 2 instructional aides. There are 16.2 students per teacher which allows some additional capacity under accepted Montana accreditation standards, depending on the age distribution of incoming students. However, because of the uneven distribution among grades, some classrooms are at capacity now (Stillwater Mining Company, 1984b, p. 33).

Absarokee high school shares some facilities and personnel, including a principal and superintendent, with the elementary school. The high school has an enrollment of 97 students and has a teaching staff of nine for an average of 11 students per teacher. The school has eight classrooms (Stillwater Mining Company, 1984b, p. 40). The school has additional capacity.

Nye and Fishtail

The Nye elementary school enrollment has ranged from 8 to 17 students over the past six years (Stillwater Mining Company, 1984b, p. 57). The current enrollment is 8 students (Stillwater Mining Company, 1984b, p. 57). The school has one teacher and one classroom with capacity for additional students.

The Fishtail elementary school has an enrollment of five students. Enrollment has ranged from 8 to 22 students over the past six years (Stillwater Mining Company, 1984b, p. 59). With one teacher and 1 classroom the school has capacity for additional students.

Solid Waste

The County Greenbox Program has over 40 disposal sites that serve the unincorporated portions of the county. The program is currently near capacity. The county disposes of waste at the Livingston incinerator and the Billings landfill, a site adequate for the foreseeable future. The county has one 32-yard, one 75-yard, and one backup trash compactor. The county plans to place another compactor on a truck recently purchased. The town of Columbus has a collection system that feeds into the county transfer site for disposal. Absarokee has a private collection system that feeds into the greenboxes for disposal (BMML, 1981).

Law Enforcement

The Stillwater County Sheriff's Department provides law enforcement for the unincorporated portions of Stillwater County. It handles dispatch service for the Columbus Fire Department, the Columbus Rural Fire District, Columbus Police Department, and the Columbus ambulance, as well as for law enforcement.

The department has the equivalent of 7 full-time sworn officers. Complaints in the Absarokee/South County district are generating a need for an additional deputy in that area; three full-time deputies are located in Columbus and two in Absarokee. The county jail has an overnight capacity of four persons. A new jail is needed, although Yellowstone County plans to construct a new jail and has indicated a desire to share that facility with neighboring counties.

Columbus City Police

The Columbus city police department has three officers and one vehicle. The department is housed in the city hall. Office space is limited but adequate for three persons (Ted Mrozek, Chief of Police, oral com., December 19, 1984). The Columbus police department shares the jail facility with the sheriff's department.

Water Supply

The city of Columbus water system serves the residents of Columbus and a limited area outside the city limits. The city has a virtually unlimited supply of water from the Yellowstone River. Average use is greater than 600,000 gallons per day. Summer use peaks at an additional 200,000 gallons per day. The system is capable of serving 1,600 to 1,700 people, which is about 100 to 200 additional persons. However, the system does have inadequacies and limitations, including a substandard water main trunk crossing the Yellowstone River, an undersized main connecting the water storage tank to the northern service areas, and some inadequately sized and looped portions of the water distribution system (Kerin and Associates, 1984). The total cost of water system improvement is estimated to be $244,750.

The Absarokee Water Users Association system serves the Absarokee town area. The system meets all state water quality standards, and could accommodate 10 to 50 new residences; however, a new well may be needed for winter supply, and some system pipes now leak. The association has an unlimited water right (BMML, 1981).

Although system capacity is adequate, the distribution system, which is suspected of leakage, loses about 125,000 gpd during winter months (BMML, 1982, p. 9-42). Replacement of leaky distribution lines began in 1980 and it is estimated that 90 percent of the lines need repair (BMML, 1982, p. 9-43). The 1982 estimated repair cost is $15,000 per 300 feet.

Sewer System

The Columbus sewer system provides service to residents in the city. The system uses two large and two small evaporation ponds. The city has no firm plans for expansion; however, the system is at capacity now. The sewage treatment ponds are at capacity now and solids build up in the sewage collection system. The sewage collection lines and manholes and manhole steps are substandard (Kerin and Associates, 1984, pp. 2 and 46). The total cost to upgrade the existing sewage ponds and provide system expansion is $506,575 (Kerin and Associates, 1984, pp. 21-22).

Rural Special Improvement District Nos. 5 and 7 operate as one district and service the residential area of Absarokee. The system consists of sewer lines and collectors and a 1.5-acre lagoon. The district needs another 7 acres of lagoon space to meet U.S. Environmental Protection Agency (EPA) standards. There is no room for expansion at the current site, but adequate space is available nearby. No funds have been identified to support the expansion. The system has a significant infiltration problem. The fecal coliform count is above EPA standards (BMML, 1981). The least expensive option for upgrading the system would demand $198,000 for capital costs and $15,000 to $20,000 for operation and maintenance costs.

Fire Protection

The Stillwater County Rural Fire Department serves the portions of the county that are outside fire districts. The department also has mutual aid agreements with the fire districts. The department is equipped primarily to handle wildfires, for which the six volunteers are considered adequate. The department is generally unable to save burning structures because of the distance to most of the county from Columbus (Terry Nystel, Chief, Stillwater County Rural Fire Department, oral com., April 1982). As a result, the parts of the county outside the fire districts are not well protected against structural fires.

The Columbus Volunteer Fire Department serves the town of Columbus. The department has 20 volunteers. The district would like to acquire one additional minipumper (BMML, 1981). The department has a limited mutual aid agreement with the Absarokee Rural Fire District, under which the Columbus Department will respond to fires within the townsite of Absarokee.

The Absarokee Fire District covers the southern part of the county and responds to calls on the national forest. The district has 28 volunteers from Absarokee and 28 from Nye. The district has adequate equipment and manpower (Eugene Lukkes, Absarokee Fire District, oral com., March 1982).

The Columbus Rural Fire District, formed in December 1983, provides fire protection to the central portion of the county. The district has a fire truck, hand tools, and other equipment. The district did not budget for operation during 1984-85, however.

City Shop

The Columbus city shop maintains the city streets (which are in fair condition), the airport, cemetery, city parks, and city buildings, and operates the town solid waste collection system (Terry Johnson, oral com., March 1982).

Ambulance

A nonprofit corporation provides ambulance service to the town of Columbus, halfway to Absarokee, west to the county line, 12 miles toward Park City, and to all of the northern portion of the county. Twelve volunteers answer an average of five calls monthly. The number of volunteers is considered adequate. Eight of the volunteers are emergency medical technicians. Park City Ambulance serves the Park City area and 12 miles west toward Columbus. The Park City service has 7 volunteers, 3 of whom are emergency medical technicians (John Bartos, Stillwater Community Hospital Administrator, pers. com., March 6, 1985). The ambulance service is fully equipped, except for a tool to cut apart wrecked vehicles to free accident victims (BMML, 1981). The southern part of the county is served by the Absarokee Ambulance, which is operated by the same volunteers as the Absarokee Fire District. None of the volunteers are certified emergency medical technicians. No additional equipment is needed. The ambulance is funded privately and responds to an average of six calls a month (Eugene Lukkes, Chief, Absarokee Fire District, oral com., April 1982).

Hospital and Medical Personnel

The Stillwater Community Hospital primarily serves Stillwater County. Fifty-seven persons are employed at the hospital, including 4.5 full-time physicians, 7 consulting specialist physicians, 9 nurses, and 3 licensed practical nurses. The hospital has maintained a nearly constant 40 percent occupancy rate over the last 3 years. The hospital has 27 beds (John Bartos, Stillwater Community Hospital Administrator, pers. com., March 6, 1985). Some Stillwater County residents use Billings hospital facilities, particularly for special problems (BMML, 1981).

Three dentists and two optometrists also serve the county. This number is adequate (John Bartos, Stillwater Community Hospital, oral com., April 1980).

FISCAL CONDITIONS

Stillwater County

In Stillwater County, general fund revenues come primarily from property taxes (Briscoe, Maphis, Murray, and Lamont, Inc. [BMML], September, 1981, p. 2-32). Between 1978 and 1981 property taxes made up an average of 60 percent of total new general fund revenues. Federal payments in lieu of taxes (PILT) and state reimbursements, the second largest source, averaged 38 percent of the total. Fees, collection, licenses and permits made up the balance. During fiscal year 1983-84, property taxes raised about $335,658 (44.4 percent) of total general fund revenues of $755,537 (Montana Association of Counties, 1985).

The major county funds--road, bridge, and poor fund--also received most of their revenue from property taxes.

The county reported expenditures of $2,111,402 for fiscal year 1983-84. Of that amount 41.3 percent was for the general fund, 25.7 percent was for road fund, 9.1 percent for the bridge fund, 7.9 percent for the poor fund, and the remainder for other purposes (Montana Association of Counties, 1985).

Schools

The elementary school and high school in Absarokee rely almost equally on local property taxes and state equalization funds for revenue. During the 1983-84 school year, approximately 41.3 percent of the elementary district and 47.3 percent of the high school district budgets were funded through district and county levies. Meanwhile, equalization funds provided 45.1 and 41.98 percent of the elementary and high school budgets respectively. The schools in Columbus were slightly more dependent on state revenues: Local revenues made up 40.4 percent of the elementary school budget and 38.5 percent of the high school budget. State equalization funds provided 40.4 and 38.5 percent of the total elementary and high school budgets respectively (Steve Colberg, Statistician, Office of Public Instruction, oral com., January 9, 1985).

Tax Base

During the 1983-84 tax year, the county tax base, or taxable value, was made up of agricultural land, improvements, machinery and productions (37 percent); other land and improvement (18 percent); Montana Department of Revenue allocations of intercounty property (28 percent); personal property (10 percent); and the value associated with oil and gas production in the county (9 percent).

Inflation steadily eroded the county tax base during the 1970s. County taxable value declined by 25 percent (in real terms) over the decade. To keep up with inflation, the total average mill levy for state, county, and school purposes steadily increased throughout the decade. Between 1970 and 1980 the tax rate (mill levy) increased by 50 percent, rising from 128.19 mills to 192.61 mills. Despite the increase, the combination of a 25 percent decline in the real value of the tax base (in constant 1967 dollars) and a 20 percent increase in population resulted in a decline in real per capita receipts. In 1970 there was an average of about $211 (1967 dollars) available for each county resident to provide basic county and educational services; in 1980 there was an average of only $197 (in 1967 dollars) available.

LAND USE

Proposed Permit Area and Surroundings

The part of the permit area that contains the mine facilities (77 acres) is dominated by mining land uses (fig. III-18). The current mining area takes

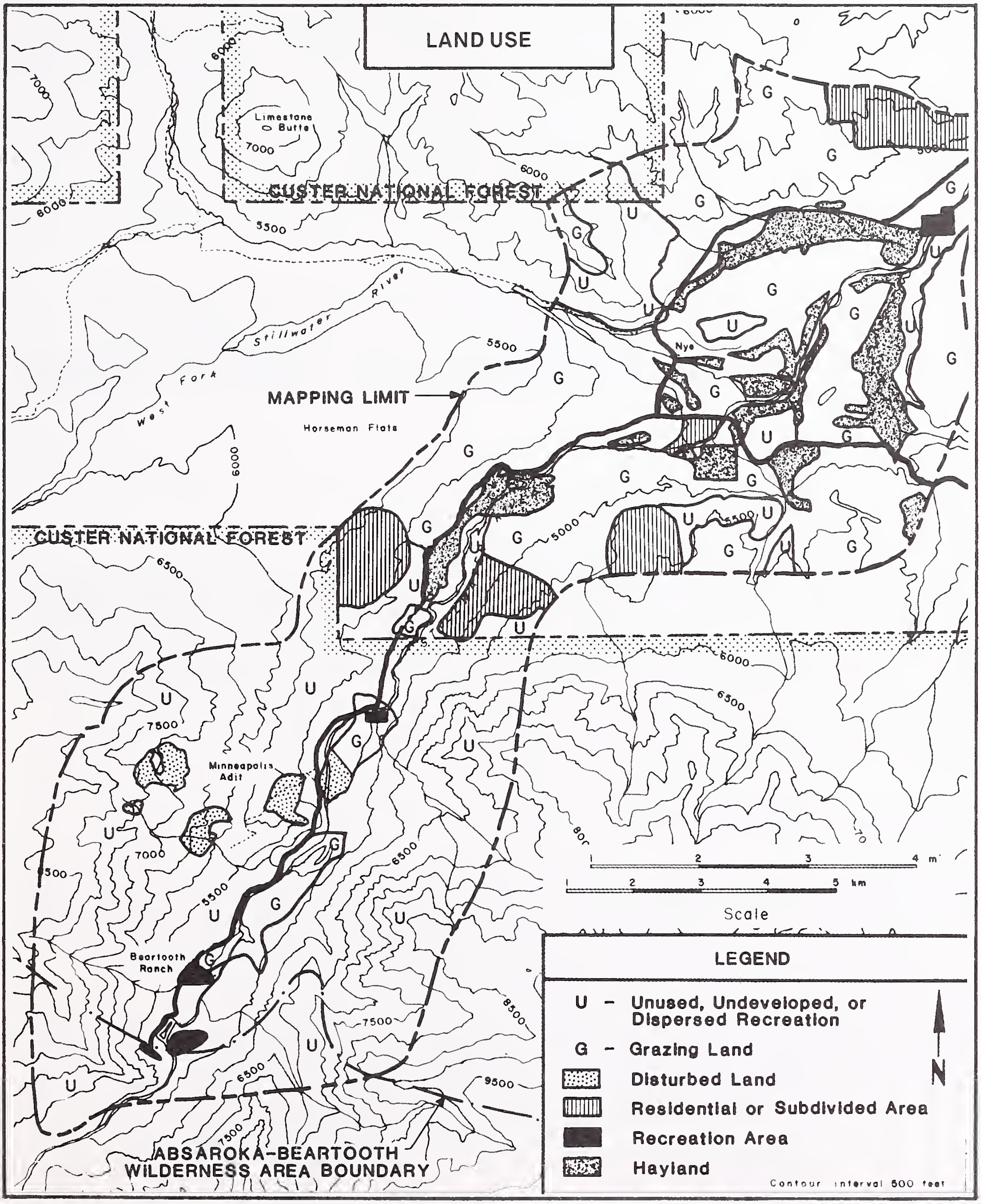


FIGURE III-18

Most of the land in and around the project area is undeveloped and used only for recreation and wildlife habitat. Most of the valley bottom is used for livestock grazing, although some lands are used for hay land and housing.

up about 25 acres, and much of the balance is made up of land previously disturbed by mining. The proposed permit area is currently in low-good range condition and has a stocking rate of 22 cow-calf units for one month (table III-15).

TABLE III-15

Stocking Rate in AUMs for Areas That Would be Disturbed by Alternatives

Alternative Number	Recommended Stocking Rate		Potential Stocking Rate	
	1 Month	9 Months	1 Month	9 Months
Proposal	22	2	22	2
1	48	5	56	6
2	57	6	80	9

The proposed permit area is located in the Stillwater River drainage in the southwest corner of Stillwater County. About 50 percent of the approximately 25,000 acres surrounding the area are undeveloped and used for dispersed recreation and wildlife habitat (Camp Dresser and McKee, [CDM]), 1981, p. 2.9-26). Agricultural use, largely livestock grazing, utilizes about 42 percent of the land of the area. Residential and recreational uses make up most of the balance.

Current and Previous Trends

No major changes in land uses or associated activities took place between 1900 and 1960 in the 25,000-acre study area around the proposed project. For this period, the Stillwater River Valley was primarily an agricultural area (CDM, 1981, p. 2.9-23); however, during World War II and the Korean conflict, U.S. price supports allowed the mining of chrome near the proposed mine.

Transitions in land uses began to occur in the late 1960s and early 1970s. The outdoor recreational potential of both public and private lands in the area attracted many people to the county and spurred the conversion of agricultural land to residential uses (CDM, 1981, p. 2.9-23). Between 1970 and 1980, about 7,000 acres of privately owned Stillwater County land were converted from agricultural to suburban tracts (Montana Department of Revenue, 1970, 1980). High interest rates and the 1974 subdivision legislation reduced the number of land sales in the county (CDM, 1981, p. 2.9-24).

Range Condition and Stocking Rate

U.S. Soil Conservation Service (1981) methods were used to calculate range conditions and stocking rates for seven vegetation types (table III-15). The remaining vegetation types (12,070 acres) have not been designated as rangeland due to the disturbed nature of the land and the lack of forage. The average condition of the study area's rangeland is good, about 57 percent of climax vegetation. The recommended stocking rate is about 5,452 cow-calf units per month, or about 606 units for 9 months. The potential stocking rate, if excellent condition (76 percent of climax vegetation) were reached, is about 7,730 cow-calf units per month or about 859 for 9 months.

The average condition of the rangeland in the proposed disturbance area is excellent, about 83 percent of climax vegetation. The recommended stocking rate is about 33 cow-calf units per month or about 4 units for 9 months. The potential stocking rate is identical. Recommended stocking rates for alternatives vary from 22 to 74 cow-calf units per month.

TRANSPORTATION

The roads that would be most affected by the proposed project are Federal Aid Secondary (FAS) 419 between Absarokee and the minesite and Federal Aid Primary (FAP) 78 between Columbus and Absarokee (fig. S-1). FAS 420 would also be affected, but to a lesser extent.

Federal Aid Secondary 419

FAS 419 is an improved two-lane roadway constructed in the early 1940s by the Montana Department of Highways (MDOH) and the U.S. government to provide improved access to the Benbow and the Mouat mines. Neither mine now operates; the roadway functions as the main route serving the communities of Fishtail, Dean, and Nye, as well as the numerous ranches and new rural developments. Area ranchers occasionally move livestock along and across the road. Recreational and tourist traffic also use this route to get to resort ranches, fishing access sites, Woodbine Campground, and the trailheads in Custer National Forest (HKM Associates, 1981, p. 5).

Average daily traffic (ADT) has been increasing on FAS 419 at a rate of 3.5 to 4.0 percent per year from 1970 to 1980 (HKM, 1981, p. 16). The 1980 ADT was 355 vehicles per day. Traffic counts made along FAS 419 declined to 324 in 1981. In 1982 ADT stood at 402; in 1983 at 282 (MDOH, 1983, p. 173). In spite of such recent erratic ADT counts, traffic is expected to grow at rates similar to those experienced between 1970 and 1980.

Both FAS 419 and FAP 78 have accident rates higher than the overall state rate. During the period January 1, 1977, through April 30, 1981, there were 90 reportable accidents on FAS 419, yielding an accident rate of 8.49 accidents per million vehicle miles (HKM, 1981, p. 18), which compares to a statewide rate of 2.89 on the secondary system. Three people were killed and 60 were injured in the 90 accidents.

The major existing problems with FAS 419 include a lack of shoulders, a number of inadequate bridges and sharp curves, inadequate signing, poor road surface condition, poor drainage, and narrow right-of-way in some areas (HKM 1981, p. 60). The design capacity of FAS 419 as now constructed is approximately 330 vehicles per hour or an ADT capacity of 2,200 (HKM, 1981, p. 63).

Bridges

There are 10 structures on FAS 419 that are classified as bridges (HKM, 1981, pp. 29-30). Trucks hauling ore and supplies from and to the minesite and mill may have to cross these bridges, depending on the route taken.

Bridges along FAS 419 are in various conditions. Only three of the 16 inspected were rated as good bridges and five received a low rating (HKM, 1981, p. 69). The other eight bridges had faults such as inadequate or no bridge rails, deteriorated concrete endwalls and wing walls, decayed and failed timber stringers, and deterioration of asphalt topping. Additionally, two of the ten bridges are single lane (HKM, 1981, pp. 56-59). Warning signs such as load limit, approaching bridge, and narrow bridge are lacking, none of the bridges has approach rails, and most have serious deficiencies in bridge deck rails (HKM, 1981, p. 31). Three bridges have load limits of under 70,000 pounds for a semitractor and trailer (HKM, 1981, p. 69).

The bridge (milepost 0) near the junction of FAS 419 and FAP 78 has been identified for improvement by the Montana Department of Highways. Project engineering is scheduled for 1988, with construction awaiting funding availability (Bill Strizich, Chief, Project Analysis Bureau, MDOH, pers. com., March 6, 1985).

The 1981 estimated cost to repair the bridges without the Stillwater Project was approximately $364,000. The cost of bridge repair with the project was an additional $91,400 (HKM, 1981, p. 91).

Federal Aid Secondary 420

FAS 420 is paved for the first 7 miles south of Absarokee and gravel from that point to Nye. FAS 420 has experienced fluctuating traffic counts, followed recently by ADT declines. In 1980, the ADT was 236; in 1981 it increased to 304 and then declined to 274 in 1982 and to 183 in 1983 (MDOH, 1981, p. 203, and 1983, p. 173).

The accident rate for FAS 420 from 1978 to 1982 was 5.14 accidents per million vehicle miles. This rate is above the statewide accident rate for secondary roads, but below the critical rate of 7.08 for secondary roads.

One bridge along FAS 420 at milepost 0 near Absarokee is scheduled for upgrading. Project engineering will be completed in 1988, with construction commencing when funding is available (Bill Strizich, Chief, Project Analysis Bureau, MDOH, pers. com., March 6, 1985).

Federal Aid Primary 78

FAP 78 was built in 1935 and improved in 1945 by the MDOH. It serves as the main north-south highway in the region. Traffic on FAP 78 remained fairly constant between 1975 and 1980 and in 1980 stood at 1,160 ADT (MDOH, 1981, p. 136). Traffic counts made on FAP 78 below its junction with FAS 420 declined to 1,140 in 1981 and then increased to 1,240 in 1982 and 1,270 in 1983 (MDOH, 1983, p. 108).

From 1976 to 79, there were 99 accidents on the stretch of FAP 78 between Columbus and the Fishtail cutoff (CDM, 1981, 2.9-12). The accident rate was 3.35, which compares to a statewide rate of 2.50 on the primary system. Seven people were killed and 35 were injured in the 99 accidents.

The major existing problems with FAP 78 include deteriorated foundations and road surface, poor drainage and a poor safety record. The MDOH currently considers 9.4 miles of the 15.8-mile segment northeast of Absarokee as deficient (MDOH, 1980, p. 93). FAP 78 has a design capacity of 450 vehicles per hour or an ADT capacity of 3,000.

FAP 78 has substandard alignment and size. Therefore, the section between Fishtail (milepost 27.4) and Columbus (milepost 46) has been scheduled for complete reconstruction. Project engineering is scheduled for 1991, with construction beginning when funds are allocated to the project (Bill Strizich, Chief, Project Analysis Bureau, MDOH, pers. com., March 6, 1985).

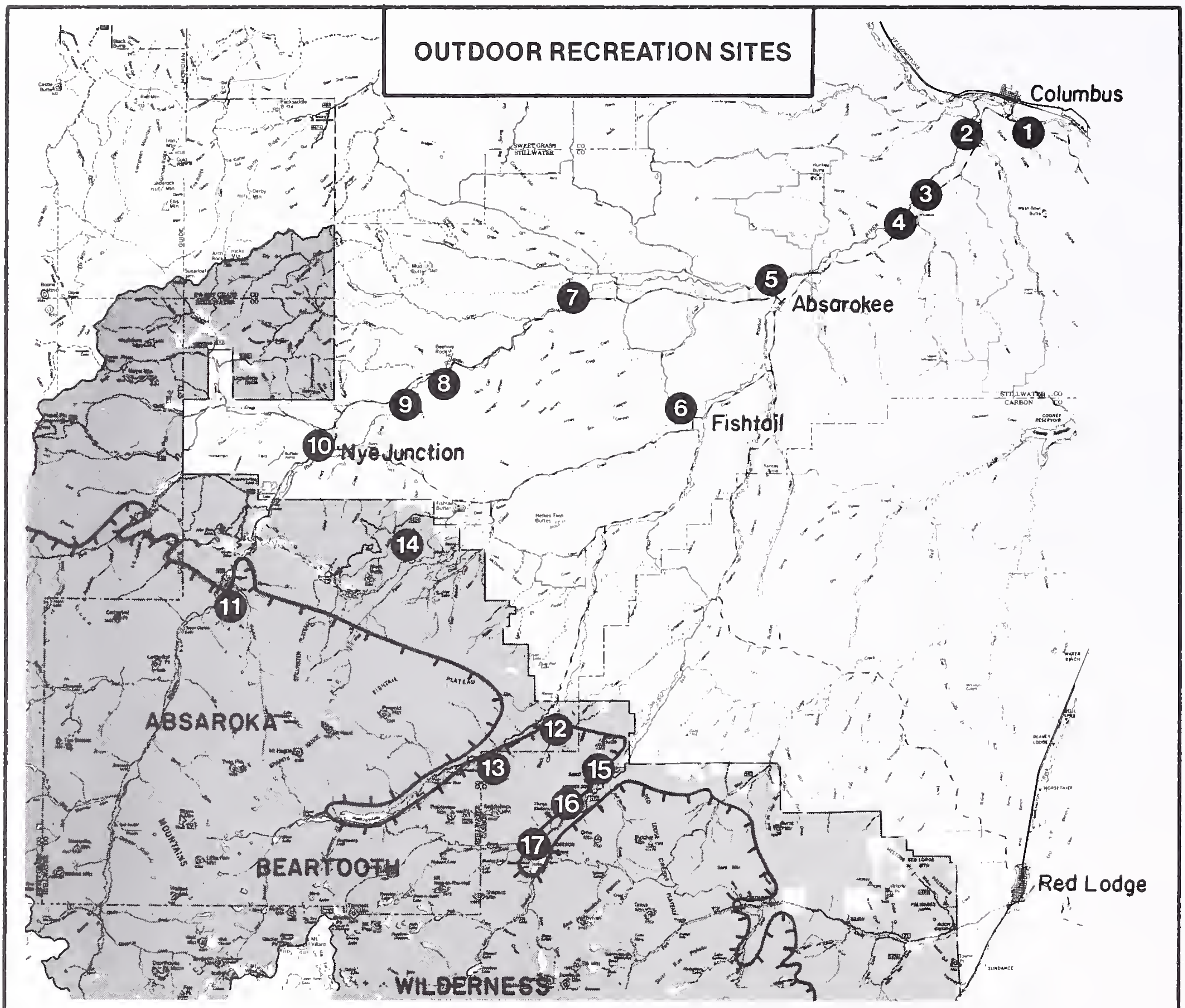
RECREATION

National Forest Recreation

The main national forest lands affected by the Stillwater Project, owing to their proximity to roads, would be the drainages of the Stillwater River and of East and West Rosebud creeks. The project may also influence peripheral areas, but to a minor degree.

About 336,000 acres of national forest system lands lie in the Stillwater and Rosebud drainages, all on the Beartooth District of the Custer National Forest. Of this total, 233,000 acres lie within the Absaroka-Beartooth Wilderness and 103,000 acres lie outside. The wilderness covers most of the lands near the Stillwater Project. In the Rosebud drainages it excludes only a narrow corridor along the roads and the north face of mountains; in the Stillwater drainage it generally follows the south side of the minerals complex (fig. III-19).

The Beartooth Mountains are characterized by majestic peaks, deep canyons with narrow bottoms and sheer walls, high tundra plateaus, glaciers, and swift, cold streams. The highest point in Montana, 12,799-foot Granite Peak, is located at the head of East and West Rosebud creeks. The national forest boundary is located at the break between foothill grasslands and steep, timbered mountain faces.



LEGEND

1. Itch-Kep-Pe: State fishing access site and campground.
2. Firemans Point: State fishing access site.
3. Swinging Bridge: State fishing access site.
4. Whitebird: State fishing access site and campground.
5. Absaroka: State fishing access site.
6. Rosebud Isle: State fishing access site.
7. Cliff Swallow: State fishing access site.
8. Castle Rock: State fishing access site.
9. Moraine: State fishing access site.
10. Buffalo Jump: State fishing access site.
11. Woodbine: U.S. Forest Service campground with fishing.
12. Pine Grove: U.S. Forest Service campground with fishing.
13. Emerald Lake: U.S. Forest Service campground with fishing.
14. Little Rocky: U.S. Forest Service campground with fishing.
15. Sand Dunes: U.S. Forest Service picnic area with fishing.
16. Jimmy Joe: U.S. Forest Service campground with fishing.
17. East Rosebud: U.S. Forest Service campground with fishing.

FIGURE III-19

Within the Stillwater and Rosebud drainages are 17 public recreation sites, in addition to 336,000 acres of national forest system lands. Just south of the project area lies the Absaroka-Beartooth Wilderness, which can be entered on foot from a trailhead at Woodbine Campground.

Each major stream is paralleled by a road that ends five to seven miles inside the forest boundary. Along the roads in East Rosebud, West Rosebud, and Stillwater canyons lie campgrounds, picnic areas, fishermen parking areas at lakes, and trailhead parking areas (see tables III-16, III-17, and III-18). Generally, less than one-half mile of trail links the trailheads with the wilderness boundary. The exception is in West Rosebud Canyon, where the boundary is about six miles from the trailhead.

The canyon of the West Fork of the Stillwater is accessed by FR 846. The distance from the mine area to the end of the road is about six miles. There are two small parking areas at the end of the road with very limited camping

TABLE III-16

Developed Campgrounds and Picnic Areas

Campground or Picnic Area	Number of Camp or Picnic Units	Persons at One Time (PAOT) Capacity
East Rosebud Lake	12	60
Jimmie Joe	10	50
Sand Dunes (picnic)	10	50
Emerald Lake	28	140
Pine Grove	46	230
Woodbine	46	230
TOTAL	152	760

Source: Recreation Improvement Records, Custer National Forest.

TABLE III-17

Developed Trailheads and Constructed Parking Areas

Name	Vehicle Parking Capacity
East Rosebud Trailhead (horse ramp)	40
Senia-East Rosebud Trailhead	5
Phantom Creek Trailhead	10
West Rosebud (Mystic) Trailhead	45
West Rosebud Lake Fisherman Parking (4 areas)	40
Emerald Lake Fisherman Parking (2 areas)	25
Woodbine Trailhead (horse ramp, corral)	50
Woodbine Falls Trailhead	8
West Fork Stillwater Trailhead (2 areas)	12
TOTAL	235

Source: Recreation Improvement Records, Beartooth District, Custer National Forest.

TABLE III-18

Occupancy Spots[1] on Public Roads--Number and Capacity

Road	Total Camp Units	PAOT[2] Existing	Potential
Picket Pin Road	6	30	0
Meyers Cr.-Lodgepole Cr.	10	50	0
West Fork Stillwater (Initial Cr.)	8	40	0
Main Stillwater	12	60	0
Benbow Road	8	40	0
West Rosebud	17	35	50
East Rosebud	34	100	70
Red Lodge Cr.	15	75	0
TOTAL	110	430	120

Source: 1979 and 1980 Inventories, Beartooth District, Custer National Forest.

[1] An occupancy spot is an undeveloped site used repeatedly for camping and/or picnicking. Potential site is defined as physically usable, but currently unused for some reason--generally poor vehicle access.

[2] Capacity in "people at one time" that can use the site.

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space. In addition, a primitive camping area, with a corral and horse ramp, lies at Initial Creek, about one-half mile before the end of the road. The Benbow, Picket Pin, Meyers Creek-Lodgepole, and Red Lodge Creek roads service no developed recreation sites, although undeveloped camping areas lie beside the roads.

The nearest large population center is Billings, Montana, about 2 hours driving time away. Billings and the Yellowstone Valley area supply about 70 percent of the national forest recreation visitors to the lands near the project.

Most recreation use occurs during the summer from mid-June through Labor Day weekend (tables III-19 and III-20). Weekend use is much higher than weekday use. Winter use appears to be increasing but use levels are unknown. Woodbine Campground and Trailhead are accessible and used almost year-round. West Rosebud Road is kept open year-round to serve people living at the Mystic Power Plant. East Rosebud Road is not plowed beyond the national forest boundary, and access to the end of the road is generally limited to May through November.

Public access to national forest lands is limited to the eight roads listed in table III-18. Most summer recreation use takes place in the canyons with fishable streams and lakes. These areas have reasonable public access, except during the big game hunting season, according to the Forest Service.

TABLE III-19

Campground Use--Average Number of Units Occupied by Month and Year

		1980		1981		1982		1984		Average
Campground	Month	Average* Units Occupied	Percent of Capacity	Average* Units Occupied	Percent of Capacity	Average* Units Occupied	Percent of Capacity	Average* Units Occupied	Percent of Capacity	Percent of Capacity (4 yr. data)
Woodbine	July	26	56	23.7	51	15.9	34	14.9	32	43
	Aug.	26.9	58	24.5	53	14.7	32	11.0	24	42
Pine Grove	July	23.2	50	24.3	52	17	37	10.5	23	40
	Aug.	16.1	35	18.7	40	26.2	56	9.0	20	38
Emerald Lake	July	24.7	83	19.6	65	19.3	65	13.8	46	65
	Aug.	19.4	65	17.9	60	19.2	65	15.5	52	60

Source: Recreation Use Records, Beartooth District, Custer National Forest.
*Based on 16-20 counts per month and from user fee records.

TABLE III-20

Average Daily Trail Use

	East Rosebud Trail			West Rosebud Trail			Stillwater Trail		
Month	1979	1980	1981	1979	1980	1981	1979	1980	1981
June	35	30	47	35	26	30	52	50	46
July	63	54	60	41	41	48	59	79	73
August	71	64	54	40	43	45	61	61	65
Sept.	35	26	35	27	15	20	40	22	41
TOTAL Visitors for a 4-month period	6,254	5,338	5,994	4,371	3,834	4,683	6,480	6,500	6,888
Change from previous year		-15%	+12%		-12%	+22%		0%	+6%

Note: Accuracy of samples from electric eye counters initiates composite error factor of ±1. Figures are in total numbers of people.

Some parts of the forest boundary are without public access. This situation exists between West Rosebud and the Benbow Road and along a 13-mile stretch of the national forest boundary just northwest of Nye. Most private landholders permit selective entry through their lands, but some are restrictive.

Demand exceeds supply for improved recreation space on national forest lands on holiday weekends and occasionally on other weekends. The average daily use of most campsites is in the 40 to 60 percent range for July and August. Typically, visitors arrive on Friday afternoon or evening and depart around noon on Sunday. This pattern creates a traffic load from 3:00 to 9:00 p.m. on Friday and from 1:00 to 6:00 p.m. on Sunday. The overload persists all the way to Columbus. Expected growth in future use, if the project were not to occur, is presented in table III-21.

All of the land in the study area will carry a certain number of visitors through time without biological degradation. This capacity varies with numbers, length of stay, habits of the visitor, and individual site factors. At the present time, on the national forest, the biological capacity has not been reached, although some sites have been closed to camping and building of fires to allow recovery.

The carrying capacity estimates shown in tables III-18 and III-22 are based on an intensive level of management. This requires at least five recreation staff in the Stillwater River and West and East Rosebud Creek drainages. As the level of management drops, the U.S. Forest Service estimates that the carrying capacity will drop. No effort was made to determine the social carrying capacity of the area.

Recreation Outside the National Forest

People also participate in dispersed activities outside national forest lands, including kayaking, canoeing, and rafting along the Stillwater and Yellowstone rivers, and fishing at 11 access sites owned by the Montana Department of Fish, Wildlife, and Parks (Camp Dresser and McKee [CDM] May 1981, p. 2.10-84). (See fig. III-19.)

The use of fishing access sites on the Stillwater River is high, according to the Department of Fish, Wildlife, and Parks. Most sites are used for picnicking as well as fishing. Visitor use of the 11 sites in 1982 ranged from 4,100 visitors at the Moraine site to 13,400 at Indian Fort, with the exception of Absarokee site, which had an estimated 500 visitors (Roy Burnsten, Regional Park Manager, Montana Department of Fish, Wildlife, and Parks, oral com., March 1982).

The state of Montana owns three campgrounds in Stillwater County with a total of 43 campsites, and 8 picnic grounds with a total of 60 sites. There is also one private campground in the county; it has 20 sites (Montana Department of Fish, Wildlife, and Parks, 1978).

Two commercial dude ranches and three outfitters operate in Stillwater County. Use is primarily by people from outside the region in the summer and fall months. Fishing, horseback riding, and hunting are the principal activities offered. Besides the activities themselves, of great importance to the

TABLE III-21

Recreation Demand Trends for the Beartooth Planning Unit

Category of Recreation	Forecasted Growth
Primitive (backpacking, mountain climbing)	+1.3% annually
Hunting, fishing, woodcutting	+3.0% annually
Road-oriented dispersed recreation	+3.0% annually
Developed campground, organization camps, tours	+2.0% annually

Source: Background Reports, Beartooth Face Planning Unit, Custer National Forest, 1978.

TABLE III-22

Wilderness Visitor Capacity

Management Unit	Camping PAOT[1]	Day Use PAOT[2]
East Rosebud	114	30
Phantom	28	15
West Rosebud	152	100[3]
Stillwater	236	125
West Fork Stillwater	86	20

Source: Records of Beartooth District, Custer National Forest: Determination of Wilderness Carrying Capacity, October 1981.

[1] People at one time (PAOT) capacity at inventoried suitable campsites in unrestricted areas along travel corridors, using acceptable camping techniques, and on a daily basis.

[2] People at one time that the day use area can sustain without unacceptable biologial impacts, on a daily basis during the summer season. Day use includes the area visited on day hikes, which generally extend no further than four to six miles from the trailhead.

[3] Includes Mystic Lake day-use area.

recreationist is the natural beauty of the surrounding area and the clean air, isolation from most manmade environment, and other more individual values (CDM, May 1981, p. 2.10-84). Seventy-five percent of Stillwater County residents surveyed state that they are satisfied with the outdoor recreational opportunities (Entercom, 1981). Of the Stillwater County residents surveyed, the activities the largest percentage participated in were driving automobiles, hiking or walking for pleasure, picnicking, or fishing (Entercom, 1981).

Community Recreation Resources

The City of Columbus has a swimming pool, 3 parks, 2 tennis courts, and 1 basketball court. The city's public works department maintains these facilities. Columbus also has 5 baseball fields, which are maintained by the teams, and a 9-hole golf course. The course is owned by the city but operated by an association. In addition, the high school gymnasium is open for public use during nonschool hours (Briscoe, Maphis, Murray, and Lamont, Inc. [BMML], 1981).

There are also organized athletic leagues in Columbus in summer and winter and a volunteer swimming instructor during the summer. Currently, there are no plans for expansion of these recreational facilities or programs (BMML, 1981).

Absarokee also has an outdoor swimming pool and one park with two tennis courts and a civic center. The park is maintained by volunteers from the Civic Club and a lifeguard is funded by the Lions Club. There are organized athletic leagues in the summer, including a swim program. Programs are supported by fund-raising efforts. There are plans to reconstruct the Absarokee swimming pool and donate the land to the county.

CULTURAL RESOURCES

A literature and archival review of existing cultural resources information for the Stillwater Project was completed by Western Cultural Resources Management during August 1980. This was followed by an on-the-ground survey of the mine, mill, and tailings site permit area, as well as an extensive area of potential environmental effect along county road 419 and the Stillwater River. A team of archaeologists walked parallel zigzag transects to locate, examine, map, photograph, sketch, and record all archaeological and historic structures, features, stone flakes, debris, or similar material encountered. In addition, rock art (paintings or drawings) within sight of the study area was recorded. The report from this study is on file at the Department of State Lands and with the Forest Service (CDM, 1981).

Twenty-three cultural resource sites were located during the survey. Of these, nine were archaeological, thirteen historic architectural, and one both archaeologic and historic. With the exception of one small cave, all archaeological sites are bison procurement or processing sites, stone rings, or cairns (heaps). Four areas of bison bone concentrations were located along the Stillwater River in association with a buffalo jump (cliff over which buffalo were driven). Stone rings and butchering areas were also noted at the jump. Two other bison processing and/or procurement areas were recorded elsewhere in the study area, as were other stone ring sites. The stone rings were probably habitation sites related to bison procurement. The stone cairns noted during the survey may have served as trail markers, caches (for food or weapons, perhaps), signal fires, horizon breaks for hunting purposes, or some other unknown function.

The cave site could have been used as an overnight campsite or cache, but is too small for group habitation. Evidence of butchered and burned bone fragments and local reports of aboriginal tools existing at the site suggest further research should be done.

The thirteen historic sites identified in the project vicinity included a wagon road, six sites associated with mining activity, and six homesteads. The oldest sites date to the 1880s, and evidence the early attempts to exploit the mineral wealth of the region. Most of the homesteads were established from 1900 to 1920. These reflect the hope of the settlers for a more permanent residence and are predominantly related to agriculture and later mining activity.

One of the above sites, the buffalo jump, was identified in the 1975 Montana Historic Preservation Plan, which is an indication of its significance in Montana prehistory. In addition, the plan identified the site of the old Nye City, in the vicinity of the project area. The recent survey, however, could locate no remnants of the town. Earlier reports speculated that the town could have been totally dismantled and moved, or that remains could have been buried under mine tailings from past operations.

One of the primary objectives of the cultural resources survey was to locate sites included on or potentially eligible for inclusion on the National Register of Historic Places (NRHP). Seven of the above archaeological sites may be eligible for the National Register (table III-23), based on their potential to yield information on the prehistory of the area, and six of the historic sites associated with mining and/or homesteading may be eligible for listing (table III-24), based on their association with significant settlement and economic patterns, their illustration of construction techniques, and their potential to yield information. Three of these sites are located on national forest lands, including unpatented claims, but only two are within the project permit boundary. The remaining sites identified during the survey are on private lands.

AESTHETICS

Visual Resources

The project area falls in the Yellowstone Rockies Character Type (USDA, Forest Service, Visual Character Types Handbook); however, CDM (1981) further divided this character type into foothill and mountainous subtypes.

Foothill Subcharacter Type

The foothill subcharacter type, located in the northern portion of the study area near Nye, comprises gently rolling, grass-covered hills with irrigated pastures and flat valley bottoms. The dominant landscape features are the Stillwater and West Fork of the Stillwater Rivers, the associated deciduous riparian vegetation, and the oblong hill located north of Nye.

TABLE III-23

Cultural Resource Sites Potentially Eligible for Listing in the National Register of Historic Places

Site Number	Site Name	Site Description	Type, Period, or Method of Construction	Location (relative to proposed action)
24S150	Eckwortzel Site	Composite/kill site/stone	Early Archaic 5000-3000 BC/Late	Outside permit area; private land
24ST52	Cave Site	Cave	Aboriginal/Historic Euro-American (Dates unknown)	Outside permit area; private land
24ST54	Guthrie Ring Site	Stone Ring	Aboriginal/Historic Euro-American (Dates unknown)	Outside permit area; private land; bisected by road
24ST401	Keogh Buffalo Jump	Buffalo Jump	Late Prehistoric, 750-1805 AD	Outside permit area; private land
24ST55	Mikesall Site	Bison Kill or Butchering Site; Homestead	Aboriginal/Historic Euro-American (Unknown to present)	Outside permit area; private land; adjacent to road
24ST69	Ruppel Ring Site	Stone Ring Site/Historic Garbage Dump	Aboriginal/Unknown Historic Euro-American; 1930s to present	Outside permit area; private land
24ST61	Stone Feature	Subrectangular Stone Cluster	Aboriginal, unknown period	Outside permit area; National Forest lands

Note: Sites have been determined potentially eligible by the Montana State Historic Preservation Office and the U.S. Forest Service.

TABLE III-24

Historic Sites Potentially Eligible for Listing in the National Register of Historic Places

Site Number	Site Name	Site Description	Type, Period, or Method of Construction	Location (relative to proposed action)
24ST53	Southworth Homestead	Homestead	Historic Euro-American, ca. 1903 to present	Outside permit area; private land; adjacent to road
24ST59	Lehner Homestead	Homestead	Historic Euro-American, ca. 1910 to present	Outside permit area; private land; adjacent to road
24ST65	Tandy Mine and Hudson Homestead	Mine and Homestead	Historic Euro-American, ca. 1903 to at least 1916	Outside permit area; private land
24ST66	Hertzler Mine	Coal Mine	Historic Euro-American, ca. 1920 or later	Outside permit area; private land
24ST67	Mouat Mine Property	Homestead	Historic Euro-American ca. 1914 to present	In permit area; private land
24ST58	Nickel Camp	Mining Camp	Historic Euro-American, ca. 1894 or later	Outside permit area; National Forest land
24ST62	Powder House	Mine Powder House	Historic Euro-American, ca 1906 or later	Outside permit area; National Forest land

Note: Sites have been determined potentially eligible by the Montana State Historic Preservation Office and the U.S. Forest Service.

Within the foothill area, the majority of man-caused landscape alterations are the result of ranching and agricultural activities. These alterations include fence lines, farm support structures, ranch houses, irrigation ditches, haystacks, and farming equipment. Some rustic structures increase aesthetic appeal. Most of the ranching activities do not adversely affect scenic quality. The only major visual alterations are second home/condominium developments, such as Cathedral Ranch.

The Hertzler Valley and Stratton Ranch Areas received an existing visual conditions (EVC) classification of 2 and 3 (Camp Dresser and McKee (CDM), 1981). This means that the appearance of the visual alterations of the natural landscape does not attract attention; that is, the natural appearance of the landscape is dominant (see appendix F).

The Horseman Flats area, while not classified by CDM, is rated at EVC of 2 by the Forest Service. That is, landscape changes are not evident to the average visitor.

The visual quality objective (VQO) for the area, based on procedures established by the Forest Service (1974), is partial retention (CDM, 1981). That is, activities may introduce new form, line, color, or texture, but the changes must remain subordinate to the characteristic landscape (see appendix E).

The visual absorption capacity (VAC) of the area is relatively high (in comparison to the mountainous subcharacter type) due to the higher vegetative regenerative capacity and gentler slopes.

Mountainous Subcharacter Type

The mountainous subcharacter type, located in the southern portion of the project area, consists of steeply elevated, angular landforms that rise sharply from the Stillwater River Valley floor. The landforms are primarily vegetated with conifers, with aspen and birch in the drainages. The steepest slopes are composed of talus or are exposed rock faces.

Although the majority of the mountainous section is free of visual impact, mine access roads and past and current mine development in the Nye Creek, Verdigris Creek, and Mountain View Creek areas affect scenic quality. The visual impact is most evident where roads cut across steep slopes and in along Verdigris Creek and in Nye Basin due to substrate/vegetation color contrasts. Revegetation and rehabilitation programs have been initiated on some of the disturbed areas (CDM, 12-Month Baseline Report, vol. II-1981).

The proposed mine and mill site is located in the mountainous section and has received an EVC classification of 4 to 5. The area where rehabilitation measures have been undertaken is EVC class 4, and the major disturbance areas due to past mining are ranked as EVC class 5. This means that the alterations to the natural landscape are easily noticed (class 4) or obvious (class 5).

The proposed mine and mill site has received a VQO of retention. To achieve this, the visual impact of activity cannot be evident. Activities may only repeat the form, line, color, and texture frequently found in the characteristic landscape.

The proposed minesite has two visual absorption capacity ratings: high VAC from the present access road down to the highway (FAS 419) and intermediate above the access.

Noise

No sound surveys have been conducted in the study area. Because the project site is rural with minimal traffic--250 average daily traffic count--and has no major development other than activity at the proposed minesite, the sound levels are probably low. Ambient sound levels measured at a rural farm averaged about 40 dB(A) (decibels) (Eldred, 1974). However, sound levels in the East Boulder River valley (Beak, 1982) were measured at 52 to 61 dB(A) with the largest source being the East Boulder River. In the Stillwater River valley, background sound levels can be expected to be about the same as those levels recorded in the East Boulder River valley. The major backround sound sources are the Stillwater River and persistent winds.

IMPACTS OF THE PROPOSAL AND ALTERNATIVES: PRODUCTION SYSTEMS

GEOLOGY

Impacts All Production Systems Have in Common

Removal of Ore

Stillwater Mining Company's mineral ownership (fig. II-3) and mine plan area constitute a small portion of the 28-mile-long zone of platinum-group metals. Mining this part of the mineralized zone would have little effect on platinum-group metal reserves of the Stillwater Complex.

Geologic Hazards

The geologic impacts of the proposal and alternatives depend primarily on the location of the tailings pond. All three tailings sites used in the alternatives could, with proper mitigation, be safely developed, without major geologic impacts. Two sites--Stratton Ranch and the minesite--may require stabilization of adjacent slopes. Despite the differences, the proposal and the alternatives would share many of the same geologic impacts.

Landslides. The company's minesite lies within or close to two surface failure complexes (landslides). The underground workings would extend under one of the landslides, and would parallel both. Camp Dresser and McKee, a consulting firm for Anaconda Minerals Company (AMC), concluded that, even though many of the slope failure complexes in the project area now appear stable, "slope failure can also be reactivated by vibration, for example seismic activity or blasting, disruption of existing drainage conditions (surface or subsurface), or removal and/or deposition of material on the failure mass, either by natural processes or construction" (CDM, 1981, pp. 2.7-2.8).

Although these failures have been disturbed by past mining, including road building and tunneling on the southernmost slide, no visible movement has occurred. The 1959 Hebgen Lake earthquake caused peak particle velocities in the Stillwater Valley of an estimated 10 percent of gravity (7.1 on the Richter Scale), but caused no movement. This indicates the slides are probably stable.

In addition, a report by Oriard (1982), a geotechnical consultant hired by Anaconda Minerals Company, concluded that there was no indication of recent slope failures in the vicinity of the minesite; nor was there any indication that regional earthquake activity or previous blasting at the site had had any effect on the old landslides. In calculating the expected vibrations from the predicted underground blasting, Oriard concluded that "the proposed blasting operations will be of intensities that are far below those that would be capable of triggering adverse reactions in the (mapped) landslides at this project site." As a result, Oriard stated there is no need for further study of the landslide potential at the site nor any need for a special monitoring program.

Still, however unlikely, movement within the slides could threaten human life, buildings, roads, timber, water, and other surface resources in the area. The actual stability of the landslides cannot be reliably determined, because the factors that control slope stability are numerous, complex, and may vary over time (e.g., water saturation). The number of factors that influence stability include the subsurface extent of potentially unstable materials, the degree of slide mass water saturation, the configuration of the underlying bedrock, and the slide material cohesiveness and shear strength.

Natural phenomena, rather than the company's activities, would probably be the cause of any slope failures. Saturation of the landslides from excessive precipitation and heavy snowmelt, or strong ground shaking caused by an earthquake, could destabilize the ancient slides. A combination of both conditions would be the most probable cause of failure.

Rockfalls. Several existing or potential rockfall areas have been identified at the minesite. The 6,550-level portal lies within one of the existing rockfall zones, an old landslide that contains numerous large boulders. As a precautionary measure, Anaconda Minerals Company constructed a concrete retaining wall to stop rocks from rolling into the portal area. The wall appears to be large enough to protect the portal area from rocks but it would do little to stop a landslide or slump. To date, no movement or appreciable rockfall has occurred as a result of Stillwater Mining Company's recent exploration work.

Earthquakes. Severe groundshaking caused by a large earthquake could cause slope failures, rockfalls, and avalanches. The 1959 earthquake at Hebgen Lake, an unusually strong earthquake for this region, is estimated to have produced peak particle velocity in the Stillwater Valley of 10 percent of gravity. No known landslides occurred as a result of this event, although several rockfalls did result. Based on the limited earthquake information available, ground shaking stronger than that is highly unlikely over the 30-year life of Stillwater Mining Company's operations (Qamar and Breuninger, 1979). Therefore, earthquakes would probably not trigger landslides in the project area during the 30-year life of the mine. Future major earthquakes could speed the deterioration of the crown pillar after mine abandonment.

Crown Pillar Failure. Cut-and-fill mining and the company's commitment to fill with sand the empty stopes in which crown pillar tests show incompetent rock would minimize, but not altogether, eliminate subsidence (see appendix E).

Weathering of the crown pillar over hundreds or more years could cause parts of the crown pillar to collapse. Tailings in the filled stopes would compact over time and could allow some minor subsidence in places where the crown pillar collapses. Over these areas, however, subsidence would be gradual, resulting in, at most, an even lowering of the overall surface.

Over empty stopes, crown pillar collapse would result in different surface expressions depending on the pattern of collapse.

In a worst-case scenario, should the pillar collapse, the unconsolidated surficial material above the pillar would fall into the uppermost mine stope, thereby exposing the underground excavations to the surface. The exposed cavity could be up to 20 feet wide, several hundred feet long and about 150 feet deep. Any surface expression of this kind would follow the trend of the proposed surface adits.

Another scenario is that because of the greater stresses at depth, spalling of the hanging wall and footwall would occur over time so that the spalled rock fragments would fill the gap between the walls. This spalling could fill the stopes, stabilize the walls, and prevent further collapse. If the failure occurred in this fashion, the subsidence could occur over a long period also resulting in a gradual, even lowering of the overall surface.

Stillwater Mining Company's proposed measures to mitigate subsidence represent accepted, current mining practices. The long-term risk to the public and to other resources posed by the crown pillar is probably low, based on experience in old mining districts. Stillwater Mining Company has agreed to take appropriate measures if any section should subside during or after mining, including bridging and filling. Temporary measures, such as signing and fencing would also be employed.

Wall Rock Burst and Scaling. Rock burst is the sudden and violent failure of wall rock. The platinum-mineralized rocks the company intends to mine are generally not susceptible to rock bursting. Anaconda Minerals Company, in its exploration work, did not encounter scaling (partially detached flakes of rock) beyond that normally found in underground mining (Jim Harrower, Anaconda Minerals Company, oral com., April 16, 1982).

Miner safety is the responsibility of the company, the mining subcontractor, and the Mine Safety and Health Administration (MSHA). MSHA and Department of State Lands representatives would periodically inspect the mine for safety compliance.

Other Mineral Resources

The company's mining operation would not preclude the extraction of the nearby chromite or copper-nickel mineralized deposits. At today's metal prices, however, these deposits are not economical to mine, and plans to produce chromium or nickel from deposits in the Stillwater complex are unknown. The environmental issues related to chromium, PGM, and copper-nickel development in the Stillwater complex was recently studied by the U.S. Department of the Interior (BOM, 1985). The various mining operations studied by the agency, however, are based on hypothetical scenarios. Without knowing development sequences and production plans, the environmental impacts of other mines cannot be reliably predicted. BOM noted that visual impacts and land use changes would be unavoidable effects of mineral development in the Stillwater complex.

Blasting

Blasting underground probably would not destabilize surficial material and cause geologic hazards, since the level of groundshaking caused by blasting would be slight. Surficial blasting during exploration broke a few windows of a home one-quarter mile from the Minneapolis adit. Blasting during active mining would be underground and would not structurally damage buildings. The air blast created by underground blasting is reduced considerably by the time it reaches the adit opening. The company would mitigate any significant public nuisances. If blasting were documented as being a nuisance, the Department of State Lands could require the company to reduce air blast effects.

Mitigating Measures

- SMC will annually report to the Department of State Lands (DSL) and the U.S. Forest Service (USFS) the results of crown pillar testing in stopes not mined by cut-and-fill stoping including, if necessary, such remedial actions taken to provide post-mining support to prevent surface subsidence. SMC will submit such crown pillar data to an independent testing company for review and comment if requested to do so by the DSL and USFS.

- SMC will submit a detailed engineering report, including plans and specifications pertaining to the proposed tailings impoundment, to the DSL and USFS for review and approval prior to initiating construction of the tailings impoundment. The report will provide engineering design information that at a minimum will:

  a. Fully describe SMC plans for construction of the minesite tailings disposal impoundment for the planned life of the impoundment including specific design criteria.
  b. Demonstrate that the properties of available materials for embankment construction are adequate to meet design requirements.
  c. Demonstrate that proper construction practices (i.e., lift height, compaction, etc.) will be used to ensure that the design requirements for stability are met.
  d. Outline a tailings impoundment embankment and foundation monitoring program to provide for detection of potential instability problems.
  e. Outline a tailings impoundment spill contingency plan describing leak detection and spill-control procedures.
  f. Demonstrate that the tailings embankment is being built to design standards by providing a schedule for performing regular inspections of the material to be used in the embankment construction and for reporting the results of the inspections annually to DSL and USFS.

Impacts Unique to the Proposal

The proposed tailings disposal methods would not adversely affect the geology of the area. Underlying geologic units are not unique. The tailings impoundment would not preclude future mining in the area. The tailings embankment would not impinge on Mountain View Creek.

Geomorphology

The reclaimed tailings pond should not appreciably change the geomorphologic character of the landscape. The pond would lie outside the 1,000-year flood plain of the Stillwater River and would be located well outside the 100-year flood plain of Mountain View Creek (Morrison-Maierle, Inc. 1983). The impoundment would not adversely affect stream stability or create excess sedimentation.

During construction, the tailings dam would be unvegetated and could be subject to heavy erosion; however, the company proposes to build a dike below the embankment to contain embankment sediment. After milling operations cease, the tailings dam and pond would be recontoured into the shape of a dome, covered with salvaged topsoil, and seeded. Initial erosion rates off the dam face would probably be high, and could approach 60 tons per acre per year (estimated using the Universal Soil Loss Equation) if measures were not taken to control erosion. During final reclamation, to prevent the loss of seeds to erosion on the impoundment dam face, the company would use temporary erosion control measures, such as the application of two tons per acre of straw mulch crimped into the ground (see Vegetation). After successful revegetation, the dam face would have low erosion rates, less than 5 tons per acre per year.

Impoundment Stability

Stillwater Mining Company's proposed tailings site lies downslope of an old surface failure complex mentioned previously. This old landslide appears to be stabilized and has not moved despite road construction and mine tunneling. The tailings would not impinge upon the landslide. The company proposes to line the pond. The gravels under the pond and dam are very porous and would thus also decrease the risk of slope instability.

The primary geologic hazard that could affect the stability of the tailings dam and pond is ground shaking caused by an earthquake. A large earthquake (e.g., magnitude 7) within tens of miles could cause the tailings dam to fail, but no major faults have been identified as being active within 40 miles (see chapter III, Geology, Geologic Hazards).

The dam would be built using downstream construction. This would keep the crest of the dam away from the finer tailings, a design preferred in earthquake-prone areas. The tailings dam would be constructed mostly with mine waste rock. Borrow material from within the impoundment would also be used in the construction.

The company plans to inspect the pond daily for slope instability. Survey monuments, placed on the crest of each dam stage, would be periodically surveyed for settlement and lateral movement. Piezometers would be installed in the dam and foundation to check the phreatic surface level.

An underdrain system and other measures to dewater the tailings would protect the dam from saturation and possible subsequent failure, particularly over the long term. The proximity of the dam to the river presents little room for intercepting seepage or for stabilizing a toe failure or slump of the dam if it were to become saturated. However, the impoundment would be constructed to standards equal to or exceeding the minimum acceptable factors of safety.

Detailed plans and specifications for dam and impoundment construction are not yet available. The company expects to furnish these in spring of 1986. Final configuration of the dam will depend on the properties of the materials used to construct it to design standards.

Mining could extend beyond the 30-year mine life. This would require SMC to raise the embankment to accommodate additional tailings or build a new tailings pond, such as at the Hertzler Valley site. The potential for extending the mine life is unknown. Raising the dam height may increase public concern about dam stability.

Impacts Unique to Alternative 1

The Stratton Ranch tailings site, although acceptable, would cover some unstable ground. The north end of the dam and pond would overlie part of the toe of the Cathedral Mountain landslide. As the impoundment is raised, the tailings could load (weight down) and increase the water content of this portion of the slide, possibly decreasing stability. Special drainage measures, such as drain tiles and the channeling of surface waters, could help prevent slope destabilization. Otherwise, water, acting as a lubricant, could cause localized failure (slides).

On the steep north- and east-facing slopes beside the impoundment site, the soils may be prone to stress failures, such as soil creep and slump. Excavating and using the surface material in dam construction would help in avoiding these failures.

Anaconda Minerals Company's consultant (Wahler, 1981) has determined in a geotechnical analysis of the Stratton Ranch site that borrow material could be taken from the Cathedral Mountain landslide. Removal of any of this material could increase the instability of the old landslide because of the shallow ground water. A slope stability analysis would be necessary to determine at what grade the cut slopes in the landslide material would be stable.

The concerns over tailings dam siting and construction would be similar to the concerns in the proposal. However, the potential for dam failure may be higher at this site than under the proposal, due to the high water table and clay content of the Cathedral Mountain landslide material. The potential for damage may be less than under the proposal. There would be more room between the dam and the Stillwater River for corrective action if failure were to occur.

Mining could extend beyond the 30-year mine life. This would require SMC to raise the embankment to accommodate additional tailings or build a new tailings pond, such as at the Hertzler Valley site. The potential for extending the mine life is unknown. Raising the dam height may increase public concern about dam stability.

Impacts Unique to Alternative 2

In this alternative, the dam at the Hertzler valley would also be constructed with earthen material. A significant advantage of this alternative is that if dam failure or seepage were to occur there would be more room to take corrective action before contaminants reached the Stillwater River. Anaconda's geotechnical studies indicate adequate sources of borrow material at the site for construction of the earthen dam.

The slurry line, routed in the borrow pit along FAS 419, would pass by some unstable slopes near the Buffalo Jump. Although the line could be routed around most of the unstable slopes, line failure could occur, although the possibility of failure over the life of the project is very low. Any spills would probably be minor and could be contained in the road borrow pit or spill control ponds (see Chapter II).

Raising the embankment to hold additional tailings to accommodate an extended mine life would likely create less concern among the public compared to either the Stratton or the minesite tailings pond locations.

No-Action Alternative

The geomorphic character of the permit area would change little. Some exploratory activity would probably continue resulting in minor surface changes. Underground tunnels from exploration would collapse over time, but surface subsidence would be negligible. A very small potential for failure of the two landslide complex would continue.

HYDROLOGY

Impacts All Production Systems Have in Common

The mine would use a portion of the ground water encountered during mining for such purposes as running the mill and cooling drills. Excess mine water would be sent to the percolation ponds. No direct surface water discharges to the Stillwater River are planned.

Up to 6 wells located a few miles downstream of the mine may have already experienced increased nitrate and total nitrogen concentrations due to seepage from existing percolation ponds. Elevated concentrations would continue and possibly increase slightly if more mine water is produced. Measured nitrate and total nitrogen concentrations next to the percolation ponds have and would continue to be well below drinking water limits (see chapter III). As such, despite moderate increases in nitrogen concentrations downstream, ground water would still be suitable for drinking.

The concentrations of metals and other dissolved constituents in the mine water are similar to concentrations found in surrounding ground and surface water. The proposed percolation ponds, therefore, would not change alluvial ground water quality except for nitrogen compounds. Stillwater Mining Company would maintain the percolation ponds as long as deemed necessary by the Montana Department of State Lands and the Montana Department of Health and Environmental Sciences.

The Stillwater River would not be influenced by percolation pond seepage (see chapter III) or the consumptive use of water at the mine.

Continued mine development would dewater more bedrock than what already has been dewatered during exploration excavations. Because of the discontinuous nature of bedrock ground water movement (fracture-controlled), the area of influence around the mine is expected to remain fairly small. No significant springs, except for the one immediately downslope of the mine and on the mine property, are expected to be affected by mine development.

The mill would not change the quantity or quality of ground or surface water. Spills of milling compounds would probably occur within the mill building, where cleanup would be easy. The company would be required to quickly attend to outdoor spills. Cleanup procedures for each chemicals used at the mine are reviewed and approved prior to operation.

After the milling reagents in the tailings slurry leave the mill, they would enter the tailings pond. Based on the following information, the mill reagents would not be expected to present a significant environmental hazard: (1) the expected concentrations of these reagents that would reach the tailings pond would be low, (2) the general toxicity of reagents is low, even at the concentrations that would reach the tailings impoundment, and (3) the amount of tailings water seeping into the ground water would be very small in comparison to the total amount of ground water flowing through the valley (see appendix C).

Mitigating Measures

- SMC will prepare, for DSL and USFS approval, a spring-flow monitoring program to collect hydrologic data designed to ascertain the effects of mine development on nearby springs. The plan will specify springs to be monitored, monitoring methods, frequency of monitoring and reporting requirements. The initial phase of the monitoring program will be implemented concurrently with the beginning of mine development activity undertaken under the Operating Permit and approved Plan of Operations.

- SMC will prepare, for DSL and USFS approval, a water-quality, compliance-monitoring plan. The plan will specify monitoring sites, sampling frequency, parameters, sampling and analytical methods and reporting procedures that will be used to analyze ground and surface water potentially affected by the project. SMC will implement the plan in accordance with a schedule outlined in the plan. The initial phase of the monitoring program will be implemented concurrently with the beginning of mine development activity undertaken under the operating permit and approved plan of operations.

Impacts Unique to the Proposal

Stillwater Mining Company proposes to locate the mill and tailings pond on the relatively flat valley bottom adjacent to the mine. Runoff water from the mill and office buildings would flow into the lined tailings impoundment. The synthetic membrane liner (36-mil hypalon) would prevent seepage from reaching the Stillwater River. Even if the pond were unlined, it would pose a minimal hazard. The milling reagents, soluble metals, and dissolved solid concentrations in the pond water would be well below the toxicity levels for aquatic life (see appendixes C and D). Pond water seeping into the ground water would be diluted by the rather high alluvial ground water flow in the valley and further diluted in the Stillwater River.

The impoundment would be located outside the 100-year flood plain of Mountain View Creek and the 1,000-year flood plain of the Stillwater River (Morrison-Maierle, Inc., 1983). Higher flood flows could encroach onto the base of the tailings pond. Even a heavy protective layer of coarse boulders (riprap) would not protect the pond's embankment from eroding during such high flows. Placing the pond at another location would be the only way the tailings could be protected against such high flood flows.

Erosion of some of the impoundment embankment by very high flood flows would add to the suspended and bedload sediment of the river, but the amount added would be so small that it would be undetectable downstream of the mine.

Stillwater Mining Company proposes to maintain the impoundment dam height well above the tailings-water level, allowing complete containment of all runoff water from the 240-acre drainage area upslope of the pond. During the first half of the pond's life, the pond would be capable of storing half of the maximum probable flood (MPF) generated by the drainage above the impoundment. Thereafter the impoundment would be designed to retain the entire MPF event.

The impoundment would eventually reach full capacity. At that time, or sooner if the mine were to shut down, the pond would be dewatered, regraded, and revegetated. Following successful revegetation, little, if any, precipitation falling on the site would infiltrate into the tailings. The minesite normally receives less than 15 inches of precipitation. Most, if not all, this moisture would be lost to evaporation or plant uptake. As such, the tailings would not pose a long-term water quality hazard, even if the membrane liner were to deteriorate over time.

Impacts Unique to Alternative 1

Tailings entering the tailings impoundment at the Stratton Ranch would have to be transported from the mill via a 2-mile-long slurry line. The likelihood of a large failure of the slurry line or of slurry dumping into the Stillwater River is low.

The tailings impoundment would abut an existing landslide deposit. Even careful design and construction of the impoundment may not be able to assure complete slide stability. Failure of the impoundment (e.g. during a severe earthquake) could send tailings into the river, although an earthquake large enough to destabilize the impoundment would probably destabilize other areas. Therefore, the site poses only a small risk; the incremental load of sediment contributed by a tailings impoundment failure would probably be small.

Very high flood flows in the tributary stream flowing along the southern edge of the Stratton Ranch site or in the Stillwater River could, as at the minesite location, introduce dam and possibly tailings material into the river. The risk of this occurring at the Stratton Ranch site is no greater than the flood risk under the proposal.

Impacts Unique to Alternative 2

The slurry line from the mill to the Hertzler Valley would be about 7 miles long, following the Stillwater River most of the way. Rupture of the slurry line could send tailings directly into the river. The likelihood of such a failure is remote and adequate safeguards such as ditches along the line and occasional collection ponds could be used to greatly decrease the hazard. If such measures were implemented, the consequences of a slurry line rupture would be greatly reduced.

The tailings pond would be located on the flanks of the Hertzler Valley in a small drainage. Since the site has almost no drainage area above it, even high flood flows would not introduce dam material or tailings into the Stillwater River.

Slump failure of the tailings dam, a very remote possibility, would deposit tailings and dam material on the flat hay fields of the Hertzler Valley bottom. Little, if any, sediment from such a slump would reach the Stillwater River.

Most of the seepage out of an unlined impoundment would be collected and returned to the system via an underdrain and sump pump system similar in design to what Anaconda Minerals Company originally proposed. The quality of ground water in the Hertzler Valley and the Stillwater River could be adequately protected via such a system.

No-Action Alternative

A small amount of ground water captured by the underground exploratory workings would continue to discharge from the Minneapolis adit as surface flow. Surface flow from the adit would be directed to the percolation ponds until the quality is determined acceptable, after which it would be released without containment. The water quality and flow of the Stillwater River would be unaffected by the Minneapolis adit discharge.

AQUATIC ECOLOGY

Impacts Unique to the Proposal and Alternative 1

Neither the proposal nor alternative 1 would have adverse effects on the aquatic ecology of the Stillwater River.

Impacts Unique to Alternative 2

Slurrying the tailings to Hertzler, would necessitate a slurry line crossing the West Fork of the Stillwater River. Even with all possible precautions, a slurry spill into the West Fork of the Stillwater River could occur, resulting in a temporary, but sharp increase in total suspended solids. Although the specific impacts to the aquatic biota cannot be predicted, the effects would be temporary, and, most likely, minor.

No-Action Alternative

The Stillwater River and its tributaries would continue to support diverse populations of cold-water aquatic organisms.

FISHERIES

Impacts Unique to the Proposal and Alternative 1

Neither the proposal nor alternative 1 would have any direct impact on fish in the Stillwater River or its tributaries. Population increases resulting from the mine operation, however, would lead to increased fishing. The magnitude of the increase cannot be accurately predicted. If the increased pressure is great enough, fish populations would be reduced.

Mitigating Measures

- SMC will periodically survey employees as to their family recreation patterns of usage in the Stillwater River basin and provide such data to the Department of Fish, Wildlife and Parks for assessment of fishing pressure and use of fishing access sites.

Impacts Unique to Alternative 2

Impacts to the Stillwater River would be nearly identical to the proposal, except that a slurry line built over the West Fork of the Stillwater River would have the potential to rupture. The required slurry line would have two walls, spill containment ponds on either side of the stream, and a pressure sensor system to halt flow in case of rupture. Still, there is a remote possibility that the line could break over the West Fork. Slurry would then enter the stream and possibly the main river until halted by the sensor system. As a result, total suspended solids would temporarily increase.

The impact of the spilled slurry would depend on (1) the volume of slurry spilled, (2) flow level of the West Fork and main river, (3) duration of the spill, (4) time of year, and (5) existing levels of suspended solids in the streams. Although the exact effects cannot be predicted, major impacts on fish would not be expected. It is extremely unlikely that unfavorable environmental conditions would occur simultaneously with a long-duration, high-volume spill. Moreover, fish are able to tolerate relatively high concentrations of suspended solids for a limited time (Stroud, 1967).

No-Action Alternative

Fishing pressure would continue to increase, although at a reduced rate due to the absence of mine employees and their families.

SOILS

Impacts All Production Systems Have in Common

Soil Quantity and Quality

With few exceptions, impacts on soils at the proposed minesite would be similar to the impacts at the Stratton site (alternative 1) and the Hertzler site (alternative 2). This assumes that Stillwater Mining Company would use the same soil salvage plans and soil amendments for the alternative sites as it is proposing for the minesite. Adequate quantities of soil are available at all three sites. In addition, laboratory analysis has demonstrated that the tailings material and other substrates are chemically suitable for plant growth and are not acid producing.

Under Stillwater Mining Company's proposal (and for the alternative sites), however, postmining soil quality would be fair at best. The company would not salvage soils in two lifts; that is, it would not salvage and store separately the surface (A_1) horizons, which contain an average of over 3 percent organic matter. The important surface horizons would be mixed with the subsoil materials and lost.

Because of the loss of organic matter and one-lift salvage, the postmining soils would have a low water- and nutrient-holding capacity. Many of the soils in the area also contain considerable amounts of gravel, further reducing the soils' capacity for holding water and nutrients. While the loss of organic matter would not cause large-scale reclamation failure, it would probably lengthen by several years the time required to reach premining vegetative densities or densities comparable to undisturbed surrounding areas. The low water-holding capacity may be partially mitigated by the semihumid climate of the area; however, most of the effective precipitation occurs between March and June (see chapter III, Climate). For the remainder of the season, droughtiness could become an important factor hindering revegetation. In addition, it would probably be necessary to add mineral fertilizers to the soil annually for several years, since most of the nutrients not used by the plants during a given growing season would probably be lost through leaching. The low water- and nutrient-holding capacity would remain low until organic matter increased from many years of vegetative growth and subsequent litter production.

The company is proposing to apply straw mulch at a rate of 2 tons per acre on all reclamation areas having slopes of 2:1 (50 percent) or less. For this analysis, it is assumed that the same treatments would be applied to the alternative sites. The proposed application rate is commonly used and considered effective for erosion control (Kay, 1980). Straw mulch generally improves environmental conditions for germination, survival, and early growth by conserving soil moisture and moderating soil temperatures (Wittwer et al., 1980).

The benefits from the mulch application would be very short term, however, since less than half the straw would probably remain after one season (Schuman et al., 1980). This is especially true at the minesite, since the company is proposing to crimp the straw into the soil with a land imprinter. A land imprinter is designed to create geometric patterns on the soil surface to control erosion, direct infiltration, and prepare a seedbed (Larson, 1980, p. 79). However, it has been found to be ineffective when used as a crimper (Dr. G.E. Schuman, USDA Agricultural Research Service, and D. Meeker, Trapper Mining Company, oral com., August 20, 1984). Regardless of the implement used to crimp the straw into the soil, the remaining straw residue, when decomposed, would add only a negligible amount of organic matter to the soil.

Biological Soil Impacts

Because reclamation of the major disturbance areas (tailings pond, mill site, associated structures) cannot begin until the mine closes, a major portion of the salvaged soils would be stored for 25 to 27 years. Soil that is stockpiled for prolonged periods is biologically and physically altered (Fresquez and Lindemann, 1982; Liberta, 1981; Miller and Cameron, 1976). Biological activity is reduced, the most common cause being the anaerobic (oxygen-free) condition created in the deeper portions of the stockpile. Seeds, spores, single cells, hyphae (fungal parts), and vegetative parts may be adversely affected (McKell, 1982).

Researchers have found that soil stored for many years may have little biological resemblance to native soils. Stockpiling of soil, especially topsoil, reduces the number of important microbes (i.e., bacteria, fungi, algae), reduces nutrient mineralization and availability, increases nitrogen losses through the process of denitrification, and decreases or eliminates the important fungus-root associations known as mycorrhizae (Rives et al., 1980; Singleton and Williams, 1979; Cundell, 1977; Miller and Cameron, 1976; Davidson, 1976). All rootzone microorganisms are important to the soil ecosystem. Parkinson (1978) suggests that a knowledge of below-ground biological systems, and mycorrhizal relationships in particular, is as important as above ground information in understanding the mechanisms of plant recovery following disturbance.

Mycorrhizae are structures that develop when certain fungi and plant roots form a symbiotic (mutually beneficial) relationship. The fungi absorb nutrients and water for the plants; the plants provide carbohydrates from photosynthesis for the fungi. The mycorrhizae serve as highly efficient extensions of the plant's roots.

Mycorrhizae are an important consideration in maximizing plant productivity as most plants depend on mycorrhizae. Malloch et al. (1980) assert that four-fifths of all land plants form mycorrhizal relationships. Some plants cannot succeed without their fungal associate (Trappe, 1981). Mycorrhizae are reported to increase plant productivity by as much as 400 to 500 percent (Davidson, 1976; Mosse and Hayman, 1971; Gerdemann, 1970). Mycorrhizae are especially important to plants' phosphorus nutrition and water uptake (Christensen and Allen, 1980).

Dilution of biological components would also occur as a result of mixing the shallow, biologically-active surface soil layer with a large amount of biologically deficient subsoils. This would result from Stillwater Mining Company's plan to salvage soils in one, rather than two lifts. The topsoil would be combined with the subsoils during removal, handling, stockpiling, and replacement.

Stillwater Mining Company's prolonged soil storage plans (although unavoidable) and proposed soil salvage plans could delay establishment of some plants (Fresquez and Lindemann, 1982) and lower postmining species diversity and plant vigor for an unknown time period. The proposed plans could also lengthen the time required for recovery to a stable, native plant community (Doerr et al., 1984). The loss of many soil microbes would be somewhat mitigated by the addition of a carbon source, such as the company's proposed straw mulch amendment or by planting a cereal grain crop. However, these amendments would have little or no effect on mycorrhizal reinfection (Lindemann et al., 1984). Migration of mycorrhizal fungi onto disturbed sites is a topic of current speculation based on a minimal amount of data (MacMahon and Warner, 1984). Artificial inoculation appears to be, at best, marginally successful on small plots (Menge and Timmer, 1982), although research is continuing (Wood, 1984).

Natural reinvasion appears to occur by several means, but the relative quantities and the ability of the inocula (spores, fungal fragments, plant parts, etc.) to survive the stresses imposed by the disturbed environment remains to be determined (Allen, 1984). Loree and Williams (1984) found that natural mycorrhizal colonization of a disturbed site was minimal after 3 years, but mean infection levels on 5- to 7-year-old sites were comparable to those of adjacent, undisturbed sites, although infection levels were highly variable. Allen and Allen (1980) found that mycorrhizal infection and spore counts in reclaimed areas increased up to 50 percent of undisturbed site levels after 2 to 3 years.

Unavoidable Soil Impacts

Some soil impacts occur whenever the natural soils are removed, stored, and replaced. These unavoidable impacts include loss of the natural soil profile and pore space continuity, an overall reduction in pore space, and a breakdown of soil structure. Because of these impacts, the reclaimed lands could be more sensitive to mismanagement and drought than prior to disturbance. These impacts would correct themselves over an unknown period of time.

Impacts Unique to the Proposal and Alternative 1

Although the impacts of the proposal and alternative 1 would not be unique, the expected low water- and nutrient-holding capacities and biological soil impacts could be easily mitigated. The Lolo soils, which cover about 63 acres (table IV-1) in the proposed disturbance area and most of the area at the Stratton site (alternative 1), are described as having surface (A_1) horizons that average 18 inches in thickness. These soils are mapped as cobbly loams in this area. Since the surface horizons contain only about 15 to 30 percent cobbles by volume, and cobbles are defined as rounded fragments ranging from 3 to 10 inches in diameter (U.S. Department of Agriculture, 1951, p. 216), a two-lift salvage of these soils is feasible. As a mitigating measure, Stillwater Mining Company could separately salvage and stockpile the surface material for just the Lolo soils. During reclamation, this would provide a veneer of topsoil material with adequate water- and nutrient-holding capacity--better than other soils replaced throughout the disturbance area.

Two-lift soil salvage could also mitigate other biological impacts at the minesite (including alternative 1) and Stratton site (alternatives 2 and 3). The biologically active surface horizons could be placed in a separate stockpile. To maintain the organisms in the stockpile, the pile's surface area could be increased by spreading out the topsoil over a greater area. The stockpile could then be immediately planted with native species so that the organisms present in the soil would persist throughout the life of the stockpile.

TABLE IV-1

Soil Resources of the Proposed Disturbance Area

Mapping Unit	Disturbance[1] Acres	Volume of Available Soil (acre-feet)
Lead-Rock Outcrop	7.1	3.0
Lolo Cobbly Loam[2]	53.2	126.4
Nesda Loamy Sand[2]	0.4	0.5
Rock Outcrop-Sale Association	9.0	1.7
Rock Outcrop-Stuck Association	10.9	3.7
Sebud Stony Loam[2]	58.3	58.0
Taxi Stony Sandy Loam	4.0	0.7
Tomy Stony Sandy Loam	3.1	4.6
TOTAL	146.0	198.6

Source: Stillwater Mining Company, 1984a.

[1] Although Stillwater Mining Company is proposing a 152-acre disturbance area for planning purposes, the company states that this estimate is conservatively high, and not all of the soils within this area would be disturbed. For example, soils under the proposed soil stockpiles and along the minesite power corridor would not be disturbed.

[2] Official, established SCS soil series. Series names given in other mapping units are unofficial, and are intended for local identification only.

The reason for spreading out the soil over a greater area is that only in the upper foot or so of any stockpile can mycorrhizal fungi and other important organisms survive and function, since they require oxygen. (Mycorrhizae also require host plants.) An expanded pile would sustain more soil microorganisms, and a greater opportunity would exist for reinfection during final reclamation.

Impacts Unique to Alternative 2

The soil impacts at the Hertzler site would be the same as those discussed earlier for the other sites. However, two-lift soil salvage would be impossible, since most soils at the site contain large quantities of stones and boulders. Therefore, water- and nutrient-holding capacities would remain low until organic matter increased from many years of vegetative growth and subsequent litter production.

The mitigations to reduce biological impacts at the minesite and Stratton site (discussed earlier) could not be applied at the Hertzler site, since a two-lift soil salvage operation would be impossible. In the case of the Hertzler site, the company may have to depend on natural reinfection, which could take many years. It is possible, however, based on current research as well as discussions and predictions in the literature, that commercial sources of mycorrhizal fungi could be available at the time of final reclamation (Wood, 1984; Cordell and Marx, 1983; Menge and Timmer, 1982).

Mitigating Measures

SMC will salvage soils from the tailings impoundment area, and other disturbed areas as feasible, in two lifts and stockpile subsoils and topsoils separately to the extent practical. Two-lift soil salvage will be undertaken when there is a clear distinction between topsoil and subsoil.

No-Action Alternative

Existing soils would continue to evolve through natural processes. The reclaimed waste rock dump near the Minnapolis adit would not be redisturbed, and soil genesis and plant succession would slowly progress with time at this site. Other areas that are presently disturbed due to past mining activites (not associated with SMC) would probably become naturally reclaimed after several decades. An exception to this could be the asphalt slab where the chromite ore was stored; no soil formation would occur at this site for a very long time, if ever. All existing disturbances that have occurred during the exploration phase (for example, waste rock dumps, ore storage piles, drill sites, etc.) would have to be reclaimed. This would be required as part of the company's exploratory license. Under such circumstances, the company's exploratory bond would not be released until such areas satisfied reclamation requirements set forth by the Department of State Lands and the Forest Service.

VEGETATION

Impacts All Production Systems Have in Common

Mine structures (shafts, yards, portals, percolation ponds, roads, and associated disturbances) would destroy 49 acres of vegetation within the permit area. The open-forest types would account for most of this acreage. Eight total acres of Douglas-fir, lodgepole, subalpine, and aspen forests would be destroyed. In addition, 28 acres of vegetation on previously disturbed land would be removed.

Different tailings pond locations and/or sizes distinguish the proposal and alternatives from each other (see chapter II). Each tailings pond would create a topsoil stockpile varying from 5 to 14 acres. Total acreages of vegetation types disturbed by the tailings ponds, stockpiles, and mining structures are shown in table III-2. The emergency tailings pond required by alternatives 1 and 2 would cover 10 acres of previously disturbed land at the minesite. Both alternatives 1 and 2 would require a 35-acre waste rock dump.

Most of the affected land would be revegetated within 2 years after mine closure. However, some areas (dams, topsoil stockpiles, diversion ditches, and cut-and-fill slopes) would be revegetated while the mine is operating. Stillwater Mining Company may seek the Department of State Lands' approval to cover some steep slopes with rocks, creating talus slopes similar to those present today. Revegetation types are not directly correlated with premining vegetation types. The company would attempt to reach its reclamation goal of creating wildlife habitat and recreation opportunities by seeding herbaceous species and by planting containerized tree and shrub seedlings. Test plots would be established during mine operation to determine the effectiveness of revegetation plans. Plans may be modified, with the Department's approval, based on test plot results. The company would evaluate final revegetation 2 years after its completion.

General Procedures for Revegetation

Revegetation would begin with the ripping of highly compacted surfaces to improve permeability to water. Topsoil would be spread on all recontoured surfaces.

The topsoil is expected to be low in nutrient and water-holding capacity (see Soils). This would limit the establishment of species used during revegetation. Small, localized vegetation failures would occur, especially where coarse-textured or gravelly topsoil is used. Salvaging soils in two lifts, where feasible, as well as the addition of soil amendments, would greatly improve plant establishment and growth (see Soils).

After seeding, 2 tons per acre of straw mulch would be crimped into the soil with a land imprinter (a towed, rolling drum; see Larson, 1980). Soils previously treated with the land imprinter may become overly compacted.

Slopes over 2:1 would be covered with jute netting or hydromulch/tackifier or straw mulch/tackifier mixtures. Unless Stillwater Mining Company uses a "clean" mulch, introduced weeds may become established and compete with other desired species for nutrients and water (Kay, 1980). All areas would be fertilized at a rate determined by site-specific soil tests.

Seeding--Herbaceous Species

Stillwater Mining Company proposes to use two seed mixtures (table IV-2). About 20 pounds per acre of the low-altitude mixture would be broadcast seeded in areas below 5,300 feet. The company would seed above that elevation with 14 pounds per acre of the high-altitude mixture. The company retains an option of drill seeding at about half the above rates. Seeding would be done in spring (April or May) or fall (October).

Species selected for revegetation are based on premining vegetation inventories. They are generally well adapted to the project area and are expected to establish successfully where not limited by topsoil quality. Blue grama and prairie sandreed, however, both species which grow mainly during warm parts of the growing season, would be difficult to establish (F. Munshower, Montana State University, pers. com., July 23, 1984; R. Brown, U.S. Forest Service, pers. com., July 24, 1984) (see appendix E for scientific names of plant species). They would probably be out-competed for water and nutrients by the cool-season grasses (species which grow mainly in cool parts of the growing season). As a result, warm-season grasses would grow only on small patches of favorable soil.

Although probably adequate to establish an erosion-controlling ground cover, seeding rates are lower than the 25 to 50 pounds per acre recommended for revegetation on the nearby Beartooth Plateau (Brown et al., 1976). A higher seeding rate would yield a more uniform ground cover (I.B. Jensen, Western Reclamation, pers. com., July 24, 1984).

If seeds are planted in the spring, the advantages of fall seeding would be lost. Fall planting gives seed a winter to meet cold-induced dormancy requirements for germination of some species (Brown and Johnston, 1978). Moreover, fall-planted seeds are in place to use favorable early spring moisture for germination. Often, this is earlier than seeding sites are accessible in spring due to snow and wet soils (Laycock, 1982; Brown et al., 1976).

In the past, high winds have hindered the revegetation efforts of the Anaconda Minerals Company (Department of State Lands and U.S. Forest Service, 1982). Anaconda Minerals Company planned to keep seeds in the ground by planting in the spring when winds are less. However, recent analysis of 1980-81 data suggests that fall wind speeds are not substantially greater than those in spring (see Climate, chapter II). Fall planting may therefore be appropriate. Mulches, drill seeding, and other measures may reduce loss of seed to wind (see Mitigating Measures).

Unless plant growth is severely limited by low water and nutrient-holding capacities, revegetation would increase short-term production of livestock forage in the disturbance area. Factors contributing to this higher productivity include (1) fertilization, (2) reduced plant competition, (3) generally

TABLE IV-2

Proposed Seeding Mixtures for Revegetation

Low-Elevation Seed Mixture		
Common Name[1]	Rate PLS (pure live seed)	Seeds per square foot[2]
Beardless wheatgrass	4.0 lb/acre	8 - 12
Western wheatgrass	4.0 lb/acre	8 - 12
Bluebunch wheatgrass	4.0 lb/acre	10 - 12
Blue grama	0.5 lb/acre	9
Prairie sandreed	1.5 lb/acre	9
Idaho fescue Sheep fescue	1.5 lb/acre	15
Canada bluegrass	0.25 lb/acre	10
Needle and thread	1.0 lb/acre	7
Green needlegrass	2.0 lb/acre	8
Arrowleaf balsamroot	0.25 lb/acre	7 - 10
Black medic	0.5 lb/acre	5
Purple prairie clover	1.0 lb/acre	
TOTAL	20.5 lb/acre	96 - 109

High-Elevation Seed Mixture		
Common Name[1]	Rate PLS (pure live seed)	Seeds per square foot[2]
Beardless wheatgrass	4.0 lb/acre	8 - 12
Bluebunch wheatgrass	4.0 lb/acre	8 - 12
Idaho fescue Sheep fescue	2.0 lb/acre	20
Canada bluegrass	1.0 lb/acre	40
Needle and thread	1.0 lb/acre	7
Silvery lupine or Silky lupine	0.5 lb/acre	
Black medic Alfalfa	1.0 lb/acre	14 - 20
Creeping foxtail[3]	0.5 lb/acre	7
TOTAL	14.0 lb/acre	104 - 118

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[1] See appendix E for scientific names.

[2] Also represents the approximate percentages of each species in mixture.

[3] May be added when the mixture is used in moist areas.

increased nutrient availability after soil disturbance, (4) high productivity of reseeded species, (5) decreased density of woody species (see below), and (6) revegetation of land disturbed prior to Stillwater Mining Company's operations.

Long-term productivity would decline to near premining levels as factors 1, 2, and 3 become less influential and as woody species invade the project area. However, short-term plant diversity would be lowered. Revegetated land would probably be dominated by the seven cool-season grasses that make up most of the seeding mixtures (table IV-2). These competitive grasses establish more readily than other species proposed for revegetation. Over the long-term, invasion by native plants would increase diversity to near premining levels.

Woody Species

Stillwater Mining Company proposes to plant 500 containerized trees and shrubs per acre on reclaimed land. Three mixtures of woody species would be used (table IV-3). Planting rates for each species would vary by revegetation site. Wood's rose would be the most often used species, constituting almost one-half of total tree and shrub planting. Lodgepole pine is of primary importance to reestablishment plans for upper elevation forests.

Even if all 500 trees and shrubs planted per acre survived, short-term postmining densities (table IV-3) would be far below premining densities (table III-2) of woody species. (Due to a lack of premining data, a comparison cannot be made for the lands disturbed by earlier mining and since revegetated by Stillwater Mining Company.) Mountain ninebark, snowberry, and Douglas-fir, commonly found in forested types, would not be reestablished. The subalpine forest contains huckleberry, rusty menziesii, currant, and subalpine fir, which would not be replaced after mining. Mortality, varying by species, would further lower density of planted trees and shrubs (table IV-3). Potential obstacles to reestablishment of woody seedlings include excessive competition for water and nutrients from herbaceous species (Ferguson and Frischknecht, 1981; Fedkenheuer et al., 1980) and damage by livestock or wildlife (Penrose and Hansen, 1981; Fisser, 1981).

Over the long term, densities of trees and shrubs would increase. Native vegetation would invade reclaimed lands. Planted trees and shrubs would begin to produce seed and/or spread by root sprouting. Still, densities would remain below premining densities for the forseeable future.

Noxious Weeds

Noxious weeds would probably not grow to any great extent on any of the reclamation areas, including roads. The company would topsoil the reclamation areas and revegetate them immediately. The reclamation areas would be monitored by the company and the agencies. If noxious weeds began to invade any specific reclamation area (which would most likely occur before planted vegetation becomes established), the company would be required to implement any management techniques necessary to eradicate the problem. In any event, the

TABLE IV-3

Planting Rates and Estimated Mortality Rates of Trees and Shrubs Planted During Revegetation

Revegetation Site	Species	Rate (#/acre)[1]	Estimated Mortality (%)[2]	Reference For Mortality Estimate[3]
Lower Elevation--below 5,300 feet (100 acres in proposal)	Wood's Rose	175-300	10	I.B. Jensen, pers. com., 7/29/84
	Big Sagebrush	25-200	25	Everett 1980
	Skunkbush Sumac	25-200	25	----[4]
	Creeping Juniper	50	40	Jackson 1982
	Chokecherry	25	16	Jensen and Hodder 1979
	Limber pine	25	40	Jackson 1982
Upper Elevation--above 5,300 ft (50 acres in proposal)	Lodgepole Pine	200	25	N. Stark, pers. com., 7/12/84
	Wood's Rose	150	10	I.B. Jensen, pers. com., 7/24/84
	Creeping Juniper	50	40	Jackson 1982
	Common Juniper	50	40	Jackson 1982
	Kinnikinnick	50	25	-----[4]
Diversion and Drainage Ditches--below 5,300 ft (2 acres in proposal)	Chokecherry	225	15	Jensen and Hodder 1979
	Aspen	125	58	Fedkenheuer et al 1980
	Wood's Rose	100	10	I.B. Jensen, pers. com., 7/24/84
	Creeping Juniper	25	40	Jackson 1982
	Dogwood	25	50	Fedkenheuer et al 1980

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[1] Rates vary among revegetation sites.

[2] Mortality rates are rough guidelines for prediction purposes. Estimates were drawn from studies with altitudes and precipitation zones as close as possible to Stillwater Mining Company's project area. Some rates were adjusted to compensate for environmental differences.

[3] I.B. Jensen works for Western Reclamation in Bozeman, Montana. N. Stark is employed by the University of Montana in Missoula, Montana.

[4] Published mortality rates were not found. The rate is based on a general shrub mortality rate of 25%.

Department of State Lands would not release the company's bond until the reclamation areas have stable and desirable vegetation communities that would support the proposed postmining land use.

Mitigating Measures

- SMC will increase the seeding rate specified in the Application for Operating Permit for portions of high altitude (above 5,300 feet) lands disturbed by mining. Herbaceous groundcover and woody plant survival will be evaluated and if excessive bare ground or erosion is observed, the ground will be reseeded.

- SMC will refertilize all seeded areas one year after initial seeding, if necessary, and will restrict domestic animal grazing on reclaimed areas for at least 2 years after initial revegetation, to the extent possible, on lands owned or controlled by SMC.

Impacts Unique to the Proposal

The tailings pond and topsoil stockpile would cover 75 acres within the permit area. Open forests and previously disturbed lands would make up almost all this acreage (table III-2). About 38 acres of affected land would be revegetated while the mine is operating (table IV-4). The remaining 114 acres would be revegetated after the mine closes.

Impacts Unique to Alternative 1

This alternative would destroy 86 acres of vegetation at the Stratton Ranch site. Impacts would be similar to those under the proposal, except that a greater amount of land would be affected. The tailings pond, emergency tailings pond, and waste rock dump would remove 56 more acres than would the proposal (table III-2). This alternative would, therefore, increase the extent of reclamation.

Impacts Unique to Alternative 2

This alternative would destroy 143 acres of vegetation at the Hertzler tailings site and require 7 to 9 miles of slurry line. An emergency tailings pond and a waste rock dump would add 45 acres to the disturbance area. This alternative would, therefore, affect 113 acres of land than would the proposal (table III-2). Due to the increased disturbance area and stonier soils at the Hertzler site (see Soils), reclaiming the alternative sites would be more difficult than reclaiming the proposed sites. However, wind speeds measured at the Hertzler site are slightly less than those at the proposed site (see Climate, Chapter III); wind erosion may therefore be less of a problem.

No-Action Alternative

Existing vegetation would continue to grow. The natural process of succession would continue to act on both native vegetation types and previously developed lands. The Department of State Lands and USFS would require SMC to reclaim all disturbance created during exploration. However, taking no action on the permit decision would forego the opportunity to reclaim 59-acres of previously disturbed lands.

TABLE IV-4

Proposed Revegetation Schedule and Revegetation Species Category, Stillwater Mine

Operation Component	Acres Disturbed	Revegetation Schedule	Revegetation Species Category[1]
Tailings pond	43	After Closure	Low Altitude
New roads[2]	27	After Closure	Low and High Altitude
Portals, shaft, yard	14	After Closure	High Altitude[3]
Mill, associated facilities	12	After Closure	Low Altitude
Percolation pond, drainage ditch	6	After Closure	Low Altitude
Miscellaneous	12	After Closure	Low Altitude
SUBTOTAL	114		
Topsoil Stockpiles	6	During Mining	Low Altitude[4]
Tailings embankment	27	During Mining	Low Altitude
Percolation pond dams	4	During Mining	Low Altitude
Diversion ditch	1	During Mining	Low Altitude
Cut-and-fill Slopes	--[5]	During Mining	Low and High Altitude
SUBTOTAL	38		
TOTAL	152		

Source: Stillwater Mining Company, 1984a.

[1] All species used for revegetation are included in either the low altitude or high altitude categories. The diversion between the category proposed is an elevation of 5,300 feet.

[2] Some roads may be left in place upon U.S. Forest Service approval.

[3] Portals 5,000 and 5,150 would receive species from the low-altitude category.

[4] The small headframe stockpile would receive species from the high altitude category.

[5] Mostly along roads. Acreage is included in the 27 acres of new roads but is currently unknown.

WILDLIFE

Impacts All Production Systems Have in Common

Impacts to wildlife can be classified as direct or indirect. Direct impacts from the proposed mine would include habitat loss and resulting displacement of wildlife, creation of different habitats during reclamation, destruction of relatively nonmobile populations, and disturbance of nearby wildlife due to mining activity and noise. Indirect impacts would include collisions between vehicles and wildlife (road kills) and demands on the environment (housing, hunting and other outdoor recreation, poaching) arising from increased human population.

The mule deer, elk, and bighorn sheep of the Stillwater winter ranges spend other seasons at considerable distances from the Stillwater Valley. Any substantial population changes occurring on the winter range would also be noticed at distant points. The amount and quality of winter range often determines population levels of big game species (Mautz, 1978). Winter energy expenditures exceeding the energy supplied by forage or body reserves affect animal health and reproduction. Developments causing disturbances of animals raise their energy cost of living, thus depleting energy otherwise available for growth and reproduction. Excessive disturbance can also increase adrenocorticoid levels in the blood, reduce birth weights, and cause absorption or abortion of embryos (Geist, 1971b).

Direct Impacts

Wildlife Habitats. Twenty-eight acres, or 36 percent, of the land that would be disturbed by mine structures (all facilities except the tailings pond and associated disturbance) consist of previously developed lands. Loss of this type would have little impact on wildlife. Some of the previously developed lands were revegetated in 1979. However, the presence of buildings, mining facilities, and pavement, combined with high levels of human activity, limit wildlife use. Mining would merely return revegetated lands to pre-1979 conditions.

Proposed mining would destroy 41 acres of the open Douglas-fir habitat (about 53 percent of lands covered by mine structures). Small amounts of disturbed forests, boulder and talus fields, and rock cliffs and benches are included in this acreage. While only mule deer, bighorn sheep, songbird, small mammal, and blue grouse use of open Douglas-fir forests has been documented, other species undoubtedly use this habitat. Loss of the 41 acres would probably not significantly affect wildlife. Displaced animals could move into the nearby and abundant Douglas-fir forest (table III-4) that would remain undisturbed. Mining would remove only 8 acres of other forested habitats. Loss of such a small acreage would not significantly affect wildlife populations, nor would habitat loss significantly affect the wildlife populations of the greater Yellowstone ecosystem. The 77 acres of habitat lost to mining represents an extremely small fraction of this ecosystem. (The greater Yellowstone ecosystem consists of Yellowstone National Park and large portions of adjacent national forests.)

The proposal and alternatives would destroy various amounts of wildlife habitats depending on the size and location of the tailings pond and associated topsoil stockpile (table IV-5). Over 90 percent of the production facilities disturbance could not be used by wildlife until it is reclaimed--at least 27 years after mining is initiated (table IV-4). The remainder would be revegetated at some point during mining. Revegetation would establish a ground cover primarily consisting of cool-season grasses (see Vegetation). These grasses, together with planted trees and shrubs, would eventually supply adequate habitat for most species. Habitat quality would probably increase over time as plant diversity increases and as woody plants mature. The revegetation of previously developed lands (the sites of buildings, ore stockpiles, pavement, etc.) would benefit wildlife.

TABLE IV-5

Wildlife Habitat Types Present in Proposed and Alternative Disturbance Areas

Wildlife Habitat Types	Acres Disturbed Proposal	Estimated Acres Disturbed Alternatives[1] 1	2
Stony grassland	3	46	131
Sagebrush shrubland	0	0	11
Skunkbush shrubland	0	6	0
Drainage bottom meadow	0	0	0
Riparian woodland meadow	0	0	0
Ravine aspen	2	7	1
Open Douglas-fir forest[2]	77	85	57
Closed coniferous forest[3]	6	5	5
Subalpine forest[4]	5	2	2
Disturbed grassland	0	0	0
Hay meadow	0	0	1
Previously developed[5]	59	57	57
Water	0	0	0
TOTAL	152	208	265

Sources: Camp Dresser and McKee 1981; Stillwater Mining Company, 1984a.

[1] Does not include acreage disturbed by slurry lines. Acreages for alternatives 1 and 2 include a 10-acre emergency tailings pond and a 35-acre waste rock dump.

[2] This type includes small amounts of disturbed forest, boulder, and talus field, and rock cliffs and benches.

[3] Consisting of closed Douglas-fir forest, closed Douglas-fir/lodgepole pine forest, and closed lodgepole pine forest.

[4] This type is a vegetation type.

[5] Includes abandoned mine areas, roads, revegetated lands, and current disturbances related to Stillwater Mining Company's exploration operations.

Mule Deer. Mule deer inhabit roughly 33,000 acres of winter ranges in the upper Stillwater Valley (fig. III-12). Production facilities would remove less than 1 percent of this range. Impacts would be greatest on deer using the Beartooth winter range. The production structures would be centered within and cover about 3 percent of this winter range. The most important habitat loss would be 41 acres of open Douglas-fir forest. Deer would probably return after revegetation is complete.

The noise and activity of mining, especially during the construction phase, may displace nearby deer. If deer response to mining activity is similar to their response to roads, deer use would substantially decrease in all areas within 1/8 mile of mining (Rost and Bailey, 1974; Perry and Overly, 1977).

Mule deer displaced by mining activity or habitat loss would move into adjacent habitats. The quality of habitat they would encounter is unknown, as is the amount of additional competition for resources they would create. Population effects cannot be predicted.

White-tailed Deer. Mine facilities would be built near white-tailed deer range along the Stillwater River. The only potential direct impact of mining would be displacement of deer due to mining noise and activity. The amount of displacement would not be great enough to cause a noticeable population decline.

Bighorn Sheep. Even without mining development, the Stillwater bighorn herd is in a precarious position. It is a small herd living on limited winter range. The herd's long history of population stability (table III-6), possibly resulting in an inability to vary reproduction (development of maintenance phenotypes), could be predisposing this herd to a decline (Geist, 1982). Bighorn herds unable to adjust reproduction that live on small patches of habitat within timbered areas may be especially susceptible. In addition, the herd may be inbred (chapter III) and therefore unable to respond to changing environmental conditions. Inbreeding can also limit productivity.

A definitive cause-and-effect relationship between historic mining activities and bighorn population fluctuations has not been demonstrated. Youmans et al. (1982) related the 1950s Stillwater bighorn herd decline to mining. Stoneberg (1977) stated that mining did not directly reduce the herd, but may have contributed to a gradual decline. Stewart (1984) believes that mining exploration is probably responsible for recent declines in lamb production. However, the herd has exhibited an overall, long-term population stability despite historic disturbances related to mining (table III-6). No population decline was noted for the 1940s, when a town capable of housing 2,000 people existed near Mountain View Lake (Stoneberg, 1977). Stoneberg (1977) correctly predicted that the herd size would remain at about 50 animals.

Mine structures would be located on the northern portion of the 1,920-acre primary winter range (fig. III-13) and destroy roughly 61 acres of the range. Loss of this range would have negligible effects on bighorn. Although bighorns now use some revegetated areas, much of the disturbance area is marginal habitat due to the long distances to escape cover, high levels of human activity, and presence of buildings and ore stockpiles. Youmans et al. (1982) agree that the effect of range loss would be minor.

Mining activity and noise may disturb bighorn occupying adjacent range. Effects would be greatest during the initial construction phase. Bighorns would be susceptible to the adverse affects of disturbance previously noted for other big game animals (Geist, 1971a, 1971b). Disturbance is likely to be least detrimental to vigorous, healthy individuals living in large populations (Geist, 1971b). The small Stillwater herd would therefore be particularly sensitive to disturbance.

Bighorns may respond to mining activity by withdrawing to the south. The precise distance of the withdrawal cannot be predicted. However, it may be only to the south side of the cliff behind Stillwater Mining Company's headquarters. The cliff would form a visual barrier between mining and remaining winter range. Visual barriers may have allowed other Montana bighorns to remain at a lambing ground despite nearby seismic activity (Andryk, 1983). The cliff would also reduce noise levels to below the 46 dB(A) predicted for FAS 419 (see Aesthetics, table IV-17). These levels would have little impact on bighorn. Reynolds (1974) found that Dall's sheep did not show significant responses to a compressor producing 58 to 73 dB(A).

Mine-related traffic would probably not cause significant disturbance to the bighorn. Large traffic increases are not expected on FAS 419 south of the mine (The road runs through the eastern part of the primary winter range.) Also, bighorn often use areas near roads and can become accustomed to traffic (Spalding and Bone, 1969; Ferrier, 1976; Horejsi, 1976; Risenhoover and Bailey, 1980). Behavioral and heart rate responses to traffic have been shown to be minimal (MacArthur et al., 1979; MacArthur et al., 1982). Bighorn, however, would be disturbed if drivers leave their cars and enter the winter range. Humans, especially when accompanied by dogs or when persistently following sheep, can adversely affect sheep (Horejsi, 1976; Bear, 1979; Stevens, 1982; MacArthur et al., 1982; Stemp, 1982).

Youmans et al. (1982) and Stewart (1984) believe that bighorn ewes are increasing their home ranges and the herd is using less favorable foraging areas. Youmans and Stewart attribute these changes to human activities and traffic increases related to mining. The subsequent decrease in energy and nutrients available for reproduction would reduce lamb production. The Montana Department of Fish, Wildlife, and Parks (letter to DSL, August 5, 1982) believes that there is a "small but very real chance" for herd elimination and that "a reduction in herd numbers is imminent" if mining is permitted. Due to the sensitive nature of the Stillwater herd, the Montana Department of State Lands agrees that increased human activities could potentially affect the bighorn population. However, further monitoring and research are required to test hypotheses proposed by Youmans et al. (1982) and Stewart (1984). Research should include (1) larger sample sizes, (2) documentation of mining and other human activities, and (3) thorough analyses of other factors affecting the population, such as weather, hunting, predation, inbreeding, and intraspecific stress.

If the herd is eliminated, natural reestablishment would be highly unlikely. However, the mixing of Stillwater rams with sheep from other herds (Stoneberg, 1977) creates a potential for natural reestablishment.

Elk. Mine structures are not included within any elk winter ranges. The nearest ranges, the Main Stillwater and Horseman Flats, are approximately 1/2 mile to the north. Studies by Ward (1976) and Perry and Overly (1977) suggest that 1/2 mile is a sufficient distance to prevent disturbance effects on elk. In addition, the Main Stillwater and Horseman Flats winter ranges receive only limited use when compared to the Picket Pin and Lodgepole ranges.

Other Big Game Species. Facilities for mining are probably within black bear spring habitat. Bears would therefore lose some habitat during mine construction and operation. Some bears may leave the area. However, if mine garbage disposal is careless, other bears may be attracted. This would increase the chances for bear/human confrontations. Mountain lions would lose a small amount of habitat, but may continue to hunt near mining facilities.

Russell (1978) has noted that hunting activities are not necessarily remote from human habitation. After replanted vegetation matures, well after mine closure, suitable bear and lion habitat would again be available. Mining would not affect moose or mountain goats.

Small and Medium-Sized Mammals. Small mammal populations would be eliminated or displaced by mining. Deer mice would be most affected, losing 41 acres of Douglas-fir forest (table III-4). The straw mulch and grasses used during reclamation (see Vegetation) would attract small mammals and allow repopulation of the disturbance area (Stockeler and Slabaugh, 1965; N. Stark, University of Montana, pers. com., July 12, 1984). Medium-sized mammals, such as coyotes and snowshoe hares, would be displaced from disturbance areas. Overall population impacts would not be noticeable and reclaimed areas would eventually supply suitable habitat.

Birds and Reptiles. Mining would make the golden eagle nest site near Stillwater Mining Company's headquarters unusable. Snow (1973) and Call (1979) suggest that high levels of human activity near eagle nests prevent successful nesting. This impact would be insignificant, since the nest has not been active since 1980. Hunting habitat for golden eagles and other raptors would be slightly reduced while the mine operates. The design of the on-site transmission line would follow guidelines suggested by Olendorff et al. (1981) to avoid raptor electrocutions.

Songbirds would leave disturbance areas until revegetation has created sufficient cover. Forest songbirds, such as mountain chickadees and evening grossbeaks, would be the most affected birds. Planted trees would supply adequate cover only after several years.

Blue grouse would move from disturbance areas as mining begins. The adjacent, undisturbed forest would probably supply adequate habitat. Revegetated areas would eventually provide suitable cover for grouse. Mining would not affect waterfowl populations and only a few reptiles would be killed or displaced.

Indirect Impacts

Road Kills. Mining would increase traffic on FAS 419, FAS 420, and FAP 78 (see Transportation), resulting in a noticeable increase in road kills. Employees commuting to the mine would create most of the traffic on FAS 419. Specific predictions are unavailable for the road south of the minesite serving the Beartooth Ranch and Woodbine Campground. However, traffic increases on this road segment would probably be much smaller than any increases to the north.

Deer would account for most of the increase in road kills. In 1980, 23 mule deer and one white-tailed deer road kills were documented. Total kill was probably much higher (Youmans et al., 1982). Generally, the chances of collisions with mule deer would increase as traffic and deer densities increase. An estimated 4 miles of FAS 419 near Twin Buttes Schools may therefore account for the most mule deer kills. (This road segment borders aerial survey units 1, 5, and 6; see table III-5). The slightly increased traffic on

FAS 420 would encounter high densities of mule deer from Beehive to Nye. (This segment is between aerial survey units 1 and 7; see table III-5.) However, road kills could occur anywhere along roads with increased traffic. Stretches passing through dense vegetative cover or alfalfa fields would prove especially hazardous. In addition, Youmans et al. (1982) identified four major white-tailed deer crossing areas along FAS 419 and one major crossing on FAS 420 (fig. III-12). Vehicles traveling through the crossings would undoubtedly kill some whitetails. Projected traffic increases would not be great enough to reduce deer use of habitat adjoining FAS 419. Carbaugh et al. (1975) found that traffic volume was not correlated with observations of whitetails.

Vehicle collisions with elk would be rare. Elk winter ranges and migration routes lie northwest of FAS 419. Some bighorns, crossing the road to reach peripheral winter range (fig. III-13) or meadows along the Stillwater River (Stoneberg, 1977) could be struck by vehicles. Road kills, however, would not contribute substantially to overall herd mortality. Large traffic increases are not predicted. Since nocturnal activity by bighorn is minimal during winter (Geist, 1971a; Risenhoover and Bailey, 1980) bighorns would not be crossing the road when collisions are most likely.

Although all other wildlife species crossing major, paved roads would be exposed to greater chances for road kills, measurable population effects are not anticipated. The most noticeably affected wildlife may be raptors, especially golden eagles, hit while feeding on carrion on the road. Road kills on mine roads would be insignificant due to warning signs and the low speeds of mine vehicles.

Housing Construction. The amount of wildlife habitat lost to mine-related housing development would be minimal. About 41 acres of housing development would be required (see Sociology and Land Use). About 80 percent of the acreage would be in or adjacent to Columbus or Absarokee (J. Beaudry, Stillwater County, pers. com., December 26, 1984). Only 8 acres would occur within the wildlife study areas. Development of this small acreage could occur in any of the county-approved subdivision sites.

Several subdivision sites are located within mule deer and white-tailed deer ranges. The already-developed Cathedral Mountain subdivision lies within the main Stillwater elk winter range and the Rainbow Ranch site slightly overlaps the bighorn peripheral winter range. Housing construction, unrelated to Stillwater Mining Company's proposal, could occur on these sites. Demand for housing would arise from population increases in southeast and southcentral Montana. Subdivisions could remove some habitat and related activities could disturb big game. Deer would be the most negatively affected species. The magnitude of the impacts cannot be predicted due to the lack of information on future housing construction. Elk would not lose additional habitat. Adequate buffers between development and elk range would keep disturbance effects to a minimum. Habitat loss and disturbance effects on the few bighorn using the peripheral ranges would not affect the total bighorn population.

Hunting. Even without the mine, demand for hunting is expected to increase in the Stillwater Valley. The mine, however, would increase the county's population (see Sociology) and further raise hunting demands. Actual hunting levels would be determined by Montana Department of Fish, Wildlife, and Parks regulations. Future hunting increases in the Stillwater Valley cannot be predicted. Hunting would not affect wildlife living near the production facilities. Stillwater Mining Company would prohibit its employees from carrying firearms. The company would also follow U.S. Forest Service guidelines on road closures during hunting seasons.

Deer hunting generates recreational and economic benefits in the Stillwater Valley. Deer ranges lie within Montana Department of Fish, Wildlife, and Parks hunting districts 520 and 572. In 1980, over 1,700 rifle hunters harvested nearly 800 deer from both districts. These hunters added an unknown amount of money to the county's economy. Some hunters probably employed the three professional guides in Stillwater County. Should the Department of Fish, Wildlife, and Parks determine that deer harvest is excessive, strict regulations may be enacted. This would limit hunting opportunity and decrease economic benefits.

Demand for bighorn hunting may increase. However, the Department of Fish, Wildlife, and Parks allows only a predetermined quota of rams to be harvested. Although no Stillwater rams were killed during the 1983 regular season, two permits were issued and filled during a late-season hunt. The level of harvest would continue to be regulated by the Department of Fish, Wildlife, and Parks.

Elk hunting would also increase in response to increased human population. Youmans et al. (1982) state that hunting pressure is already considerable. Landowners currently in conflict with elk may desire even more hunting. Bull harvest is open to all permit holders, while cow harvest is regulated by limited permit sales. Annual harvest by rifle hunters generally ranges from 10 to 20 animals with a very low success rate for bull hunters. The Department of Fish, Wildlife, and Parks would continue to regulate the harvest. If bull hunting becomes excessive, the Montana Department of Fish, Wildlife, and Parks could institute a quota or a limited-permit system (Youmans et al., 1982; Montana Department of Fish, Wildlife, and Parks, pers. com. August 5, 1982). This would decrease hunting opportunities, especially for non-residents. Professional guides in Stillwater County would lose substantial amounts of income.

If hunting of black bears increases and harms the bear population, the Department of Fish, Wildlife, and Parks (pers. com., August 5, 1984) could close seasons. Reducing or eliminating bear season would create an adverse, although insignificant, impact on Stillwater County's economy. Although mountain lions would also be hunted more frequently, the amount of hunting and resulting impacts cannot be predicted. Populations of small game species would not be limited by increased hunting.

Other Recreation. Mine-related population increases would lead to more recreation activities (such as snowmobiling, hiking, camping, four-wheel-driving) on big game winter ranges. This increase would be added to the growth forecasted without the mine (table III-21). The locations and extent of total recreational increase are unknown. Therefore, precise predictions of effects on wildlife cannot be made. High levels of snowmobiling, anticipated for the Picket Pin and Lodgepole elk ranges (Youmans et al., 1982), could cause disturbance effects on elk and result in a distributional shift. The time that recreationists would spend on bighorn winter range cannot be predicted. However, even low levels of human activity could adversely affect bighorn.

Poaching. Some poachers would be included in the influx of people to Stillwater County. Their numbers cannot be predicted. All wildlife, especially big game, would be subject to poaching. Remote areas with nominal road access may receive the most poaching. Poachers would probably operate only infrequently near areas of human activity, such as FAS 419. This may help to protect the white-tailed deer and bighorn populations. High visibility of law enforcement officers and strict enforcement of game laws would also reduce poaching. Stillwater Mining Company would discourage poaching by prohibiting firearms on the permit area.

Mitigating Measures

- SMC will prepare, for DSL and USFS approval, a plan to monitor the effects of mine development and operation on the Stillwater bighorn sheep herd. The plan will describe the objectives, methods, cooperative work schedules, and reporting requirements for undertaking such studies and will outline a bighorn sheep impact mitigation contingency plan. The plan shall be submitted for agency review prior to initiating mine development activity undertaken under the Operating Permit and approved Plan of Operations. Initial research activity specified in the plan such as vehicular traffic monitoring along FAS 419 in the area of the bighorn sheep wintering range will be implemented prior to mine development.

  Approval of the full monitoring and impact mitigation contingency plan will be obtained from the DSL and USFS within 90 days following approval of the operating plan.

- SMC will carry out an employee education program about the adverse effects of disturbance on bighorn sheep and discourage nonessential entry into bighorn range during winter months.

Impacts Unique to the Proposal

The tailings pond and associated topsoil stockpile would cover 75 acres of wildlife habitats within the permit area. The proportion of habitats destroyed by the tailings pond would be similar to those destroyed by the tailings pond and production facilities combined (table IV-5). Most (75 percent) of wildlife habitats could not be used by wildlife until revegetation is completed.

The proposal would remove about 7 percent of the Beartooth mule deer range. The most important habitat loss would be 77 acres of open Douglas-fir forest. Roughly 129 acres, or 7 percent, of the primary bighorn winter range would be destroyed. Noise and activity created by tailings pond construction would be added to that produced by production facilities construction. Raising the dam would also create noise and activity at 4- or 5-year intervals during the 3- to 4-month construction period. Adverse effects on deer and bighorn may be increased.

Impacts Unique to Alternative 1

This alternative would destroy 86 acres of wildlife habitats at the Stratton Ranch site. More habitat would be disturbed than under the proposal. However, locating the pond at the Stratton Ranch site would reduce impacts on mule deer and bighorn. The pond site lies between the Keogh and Beartooth mule deer ranges and is over 1 mile from bighorn range. Effects on bighorn would be somewhat lowered due to the absence of nearby dam construction. The Stratton Ranch pond site borders the main Stillwater elk range and, therefore, its construction could disturb elk. Overall impact to elk would be minor because of the limited elk use of the main Stillwater range. Impacts on all other wildlife species would be similar to those of the proposal.

Impacts Unique to Alternative 2

This alternative would destroy 143 acres of wildlife habitats at the Hertzler site and require 7 to 9 miles of slurry line. Adverse effects on mule deer would be greater than the proposal's effects. Stony grasslands and a one acre of hay meadow, both important to mule deer, would be covered by the pond. Also, densities of deer are higher at the Hertzler site. Bighorn would be less adversely affected than if mining proceeds as proposed. The bighorn would not lose marginal range. Bighorn would not be exposed to disturbance effects due to dam construction. Effects of alternative 2 and effects of the proposal on elk and other wildlife would be similar.

No-Action Alternative

Wildlife would likely continue to occupy their present ranges. However, future development could affect wildlife. Even without SMC's mine, the future of the bighorn herd would remain tenuous. No action would relinquish the opportunity to reclaim 59 acres of potential wildlife habitat. SMC would be required to reclaim all disturbance resulting from exploration.

THREATENED AND ENDANGERED SPECIES

The U.S. Fish and Wildlife Service has determined that the Stillwater project would be unlikely to jeopardize the continued existence of the peregrine falcon or the bald eagle (see Chapter III, Threatened and Endangered Species).

Impacts All Production Systems Have in Common

The increased traffic on FAS 419 is expected to increase the incidence of wildlife road kills. Bald eagles attracted to carrion along roadsides could be hit by commuting workers and recreational motorists. Bald eagles could also be shot at by passing motorists. The effect that increased traffic and harassment would have on the bald eagle population is unknown, although it would probably be minor.

Activity levels at the mine, especially during shift changes and peak construction, may discourage bald eagles from feeding along approximately a half mile of the Stillwater River next to the mine. Bald eagle feeding habitat lies within 1/4 mile of the minesite. The importance of this river reach to bald eagles is unknown, although the project could decrease suitability of this stretch of river as feeding habitat for bald eagles.

Mitigating Measures

SMC would be required to implement a traffic-reduction program. This program would help reduce the risk of bald eagle road kills and would decrease the potential for disturbance of feeding habitat near the minesite (see Transportation).

Impacts Unique to the Proposal

There are no impacts unique to the proposal.

Impacts Unique to Alternative 1

The tailings pond at Stratton Ranch would be constructed within 1/2 mile of a bald eagle roosting area and next to potential nesting habitat. Although nesting of bald eagles in the Stillwater drainage has not been documented, roosting and potential use of suitable nesting habitat could be discouraged, especially during periods of dam construction

Impacts Unique to Alternative 2

The tailings dam at the Hertzler site would disturb less than 2 percent of potential hunting habitat available for use by peregrine falcons and bald eagles. The amount of a habitat affected would have negligible effect on the area's ability to support bald eagles and peregrine falcons.

The tailings dam, because of its distance to the West Fork of the Stillwater, would have no effect on use of potential nesting habitat by bald eagles. The peregrine falcon cliff complex would be unaffected by the operation of the tailings pond.

No-Action Alternative

The suitability of bald eagle feeding habitat adjacent to the proposed minesite would not be jeopardized. Bald eagles would use riparian woodlands and open habitats for feeding, roosting, and perching. Traffic on FAS 419 would continue to increase, but at a lower rate. Therefore, the potential for bald eagle road kills would also increase.

CLIMATE

The small amount of particulate emitted from ground level sources during mining and milling would not affect the climate of the area.

AIR QUALITY

Impacts All Production Systems Have in Common

Particulate emissions from the mining and milling operations would be minor. Total emissions would be about 29 tons per year (table IV-6). The major source would be vehicle traffic, accounting for 14 tons per year, or nearly 50 percent of all emissions. Ventilation exhaust would emit 7 tons per year, or 25 percent of the total emissions. The crushing and conveying system would be enclosed, and exposed areas would be revegetated. Hence, these sources would emit only a small amount of particulate (table IV-6). SMC would maintain standing water over the tailings pond. Therefore, no dust would be emitted from the pond.

TABLE IV-6

Inventory of Emission Sources

Source	Total Emitted TSP in Tons/Year
Ventilation Exhaust	7.2
Dump Waste Rock	0.1
Coarse Ore Stockpile	0.1
Waste Rock Storage	0.3
Tailings Embankment	0.7
Apron Feeders Both Levels	0.2
Dump Coarse Ore Storage	0.2
Conveyor to SAG Mill	0.1
54-inch Conveyor	0.1
Ore and Waste Loading - 5,000 Level	1.8
Grizzly Both Levels	0.7
Train Dumps Both Levels	0.1
Waste Loading - 5,150	0.6
Topsoil Storage Pile	0.1
Waste Rock and Hauling from 5,000 Level	1.4
Vehicle Traffic	14.0
Coarse Ore Storage	0.1
Thermal Dryer[a]	1.3
TOTAL	29.1

Source: CDM, August, 1984.

[a] Point Source

Camp Dresser and McKee (CDM, 1984) used the EPA VALLEY model to predict total suspended particulate (TSP) concentrations near the mine. Using a production rate of 1,000 tons of ore per day, and local meteorological data, the annual average TSP concentration was predicted to increase by 3 $\mu g/m^3$. When added to the background TSP concentrations of 14 $\mu g/m^3$, the total annual average TSP concentration of 17 $\mu g/m^3$ would be only 23 percent of the Montana Ambient Air Quality Standard (MAAQS) of 75 $\mu g/m^3$.

The maximum increase in the 24-hour TSP concentration was predicted to be 16 $\mu g/m^3$ (CDM, 1984). When added to the maximum background 24-hour concentration of 41 $\mu g/m^3$ measured at the minesite, a total of 57 $\mu g/m^3$ can be expected. This would be only 28.5 percent of the Montana AAQS of 200 $\mu g/m^3$.

Ore concentrate would be stored in sealed containers and trucked to Columbus for shipment by rail to various markets. No concentrate particulate would be emitted during hauling to Columbus.

The presence of potential mutagens and carcinogens in the ore and concentrate was of major concern to the Montana Air Quality Bureau (AQB). However, the evaluation of potential emissions from mining and milling activities indicates that the particulate concentrations would be low. The AQB therefore determined that adverse health impacts would probably not occur (H. Robbins, Chief, AQB, written com., March 1982). Other research shows that the miners' health probably would not be adversely affected (National Research Council, 1977).

During the construction of the mill and mine complexes, disturbed areas might be eroded during high winds. This would be temporary only and is not anticipated to affect average TSP concentrations.

Impacts Unique to the Proposal and Alternatives 1 and 2

The proposal and alternatives 1 and 2 would have similar effects on air quality.

No-Action Alternative

Air quality in the project area would continue to be excellent. However, wind erosion of previously disturbed sites and vehicle traffic on unpaved roads would continue to be the primary sources of particulate emissions.

EMPLOYMENT AND INCOME

Employment Impacts All Production Systems Have in Common

During the first year of mine construction, the company would employ 100 to 150 people. Ore withdrawn from development of stopes and portals would be stockpiled near the mine. If information gathered during the initial development were positive, the company would begin mill construction in the second year and would employ up to 300 people at peak activity.

During the initial operations phase, the company expects to operate the mill at 500 tons per day capacity and hire 200 employees. After 1991 the milling rate is projected to double to 1,000 tons per day and employment levels would average at least 220 workers annually. The company expects to hire 89 employees from the local area.

The construction of the tailings impoundments would be done in stages. The embankment would be raised in stages as the impoundment filled, necessitating hiring 50 short-term, temporary workers in about the fourth, ninth, and sixteenth years of full-employment operation (see fig. IV-1).

The 220 operations jobs represent a 10.3-percent increase over the total number of jobs in Stillwater County in 1982. Of these new permanent jobs, 54 percent, or 120 jobs, are expected to be filled by persons moving into Stillwater County. Approximately 40 percent, or 89 positions are expected to be filled by Stillwater County residents (Stillwater Mining Company, 1984b, p. 8). The balance of the jobs are expected to be filled by persons who commute from outside the county.

Approximately 50 percent of the construction-phase jobs are expected to be filled by local residents and 50 percent are expected to be filled by persons who commute or move into the county (Stillwater Mining Company, 1984b, p. 6). A number of construction-phase positions would be continued as permanent positions.

Local government and business employment could increase by approximately 83 jobs due to increased mining employment. These jobs most likely would be filled by local residents (Stillwater Mining Company, 1984b, p. 6).

Permanent closure of the project, whether after the scheduled 30 years or earlier, would shrink the employment base to what it would have been if the mine had never existed. Persons laid off from the operation would--

- Leave the area seeking employment.
- Remain in the county and commute to jobs outside the area.
- Remain in the county and take early retirement (if they have worked long enough for the company).
- Remain in the county and compete for other jobs in the county.

A temporary closure would have an impact directly related to the length of the closure. If the closure were short, less than six months, only the mine workers themselves would be affected. If the closure were to last long enough, the impact would approach that of a permanent closure.

Income Impacts Common to All Production Systems

Annual wages of mine and mill employees would range from $14,500 for secretarial positions to $50,000 for management positions (Les Darling,

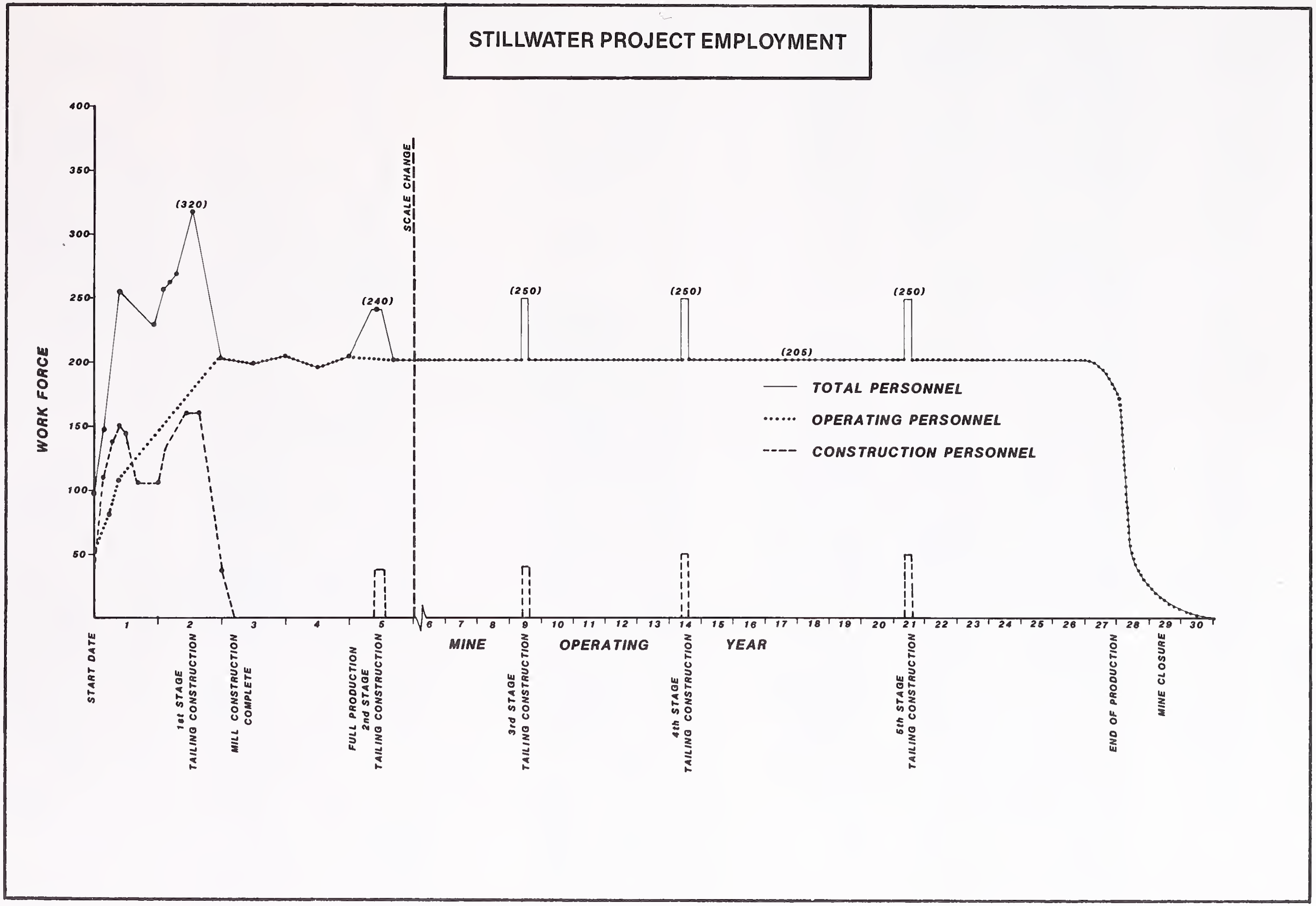


FIGURE IV-1

Although the work force for the project would in most years total 205 workers, the company would employ as many as 300 during the initial construction years. Eighteen additional jobs would be added each year as positions are vacated due to illness, absenteeism, and sick leave. After the mill reaches full production, employment would reach 250 each time the tailings dam is raised.

Stillwater Mining Company, pers. com., Dec. 18, 1984). In 1981, three-fourths of the respondents to a county survey reported annual gross incomes below $24,000 (Entercom, 1981, p. 4-15). Average annual wages paid at the mine could range from $22,669 to $26,310.

An early closure of the project would have essentially the same impact on income as the scheduled closure of the project. The wages and salaries paid by the company would cease and per capita income would go down. To the extent that the laid-off mine workers were able to remain in the area and commute to other jobs or take early retirement, the decline in income would be reduced.

A temporary closure would have an impact directly related to the length and cause of the closure. If the closure lasted long enough, its impact would approach that of a permanent closure. To the extent that unemployment benefits would be available to workers, the income loss would be reduced.

Ordinarily, the additional payroll provided by the project would dampen the effect of year-to-year variations in agricultural income. However, should the payroll be interrupted during a poor agricultural year, the instability in total personal income would be intensified.

Impacts of Extended Mine Life

The impact on county income and employment of a project life longer than 30 years would depend on the level of mine employment. If mine employment remains at the same level as the 30-year plan, employment and income impacts would be the same as for the 30-year plan. If mine employment declines, county employment and income would fall. If mine employment increases in a 30-year (or longer) mine life, county income and employment would increase.

No-Action Alternative

Employment in Stillwater County will continue to grow at a modest rate, probably between 1 to 1.5 percent annually over the next 20 years. The 220 operations-phase jobs, which represent a 10 percent increase above 1982 county employment levels, would be forgone. The number of county residents who commute to jobs outside the county will continue to account for a high proportion of the employed residents. Agriculture, services, and state and local government will continue to be the major source of jobs in the county, although agricultural employment will decline moderately over the next 20 years. The mining sector will provide a minor number of jobs compared to most other sectors.

Income will increase moderately over the next 20 years at about 1 percent per year excluding inflation. Income generated by the mining proposal would be forgone. If income is proportionally related to employment, such forgone income could be about 10 percent of 1982 county-wide income. In the short term, agricultural income will most likely show little improvement. Nonlabor income (dividends, interest and rent) will continue to be an important component of total county income. Mining sector earnings will be small relative to those in other industries.

SOCIOLOGY

Impacts All Alternatives Have in Common

Demography

The additional population added by the Stillwater Project would be distributed throughout Stillwater County (table IV-7). Eighty percent of the 120 inmigrating mine workers are expected to be married and have three dependents each. Total direct mine-related in-migration is expected to be 408 persons (Stillwater Mining Company, 1984c, p. 8a). Some additional employment in-migration is also expected; however, it will be minor. Approximately 45 persons may in-migrate to Stillwater County to fill jobs created by mine-induced employment growth and to fill jobs vacated by local residents who go to work for the mine. Teachers and police officers would be examples of the latter. Forty-six percent of the 45 in-migrants are expected to be married and have 2.5 dependents each for a total secondary in-migrating population of 97 (Stillwater Mining Company, 1984c, p. 8a). Total in-migrating population due to the Stillwater Project is expected to be 505 to 510 persons.

TABLE IV-7

Population Projections With and Without the Stillwater Project

Area	1995 Population Without Project	1995 Population With Project	Percent Increase
Stillwater County	6,515	7,025	7.8
Absarokee	890	1,110	24.7
Columbus	1,655	1,845	10.3
Fishtail-Nye	700	760	8.6
Columbus Division	510	550	7.8

Source: Stillwater Mining Company, 1984c, p. 11a.

The distribution of in-migrants would depend on housing availability within commuting distance of the mine, and personal preferences for different community amenities. Table IV-8 shows the expected distribution of in-migrating persons throughout Stillwater County. It should be noted that in-migrants may not settle in the anticipated patterns. Some could choose to live closer to the mine, increasing the number in the Nye-Fishtail area, rural areas outside Absarokee, and Absarokee.

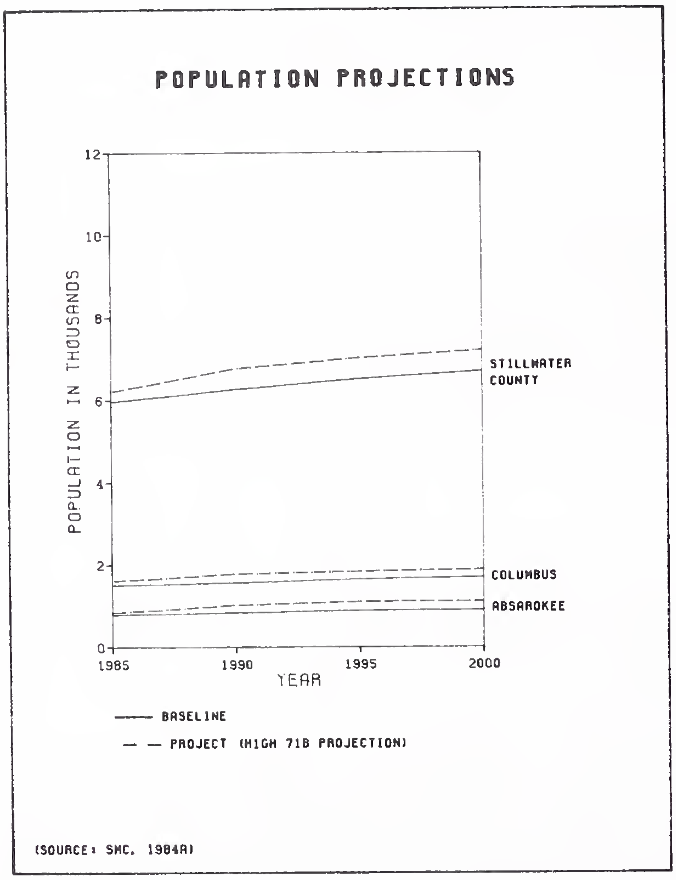
The population of Absarokee is expected to grow the most--27.8 percent from 1984 to 1995 (fig. IV-2). The flow of people into Absarokee would be limited by the availability of housing and the capacity of the sewer and water system (see Community Services). The Columbus population would grow 12.7

TABLE IV-8

Expected Distribution of Persons Moving into Stillwater County

Location	1984	1990	1995	2000	Population Increase from 1984 to 1995
Absarokee	790	190	220	220	27.8%
Columbus	1,500	200	190	190	12.7
Fishtail-Nye	660	80	60	60	9.1
Columbus Division	530	40	40	40	7.5
Stillwater County	5,900	510	510	510	8.6

Source: Stillwater Mining Company, 1984c, p. 11a.



(SOURCE: SMC, 1984A)

FIGURE IV-2

The town most affected by the project would be Absarokee, whose population in 1995 would be nearly 25 percent greater than in 1985 as a result of the project. The population of Columbus would be only 10 percent larger and Stillwater County as a whole only 8 percent larger.

percent from 1984 to 1995. The Fishtail-Nye area would grow about 9.1 percent during the same period and the Columbus Division would grow about 7.5 percent. Stillwater County as a whole would grow 8.6 percent due to the project.

At the close of operations, whether at the scheduled 30 years or earlier, a significant percentage of the mine-induced population could leave the county. Exactly how many people would leave after a permanent closure depends on individual factors, such as the possibility of early retirement, other income, and the chance of obtaining a job elsewhere. The largest outflow could be from Absarokee, since the community would contain a large percentage of the mine-induced population, could not provide many other jobs, and is beyond commuting distance to other areas with job opportunities. Columbus would probably shrink less.

Most population decline in the area would occur gradually, not immediately. The rate at which people leave would depend on a variety of factors, such as the benefits received, the length of unemployment, the season of closure, and ties to community family and friends.

Values

How the values of newcomers would differ from current residents is not known. How much commitment they would have to their new community is not known.

Housing

The current housing stock in Columbus, Absarokee, and Stillwater County is inadequate to accommodate the in-migrating labor force of the Stillwater Project (Housing Development Associates, 1984, p. 27). Furthermore, the early demand for temporary and permanent housing during the first 24 months of the project would be greater than the amount of housing needed throughout the life of the project. The severity of the problem would be influenced by the location of in-migrants and the scheduling of hiring by the company.

Local housing contractors in Stillwater County and the Billings area indicated that 200 dwelling units could be constructed annually if demand for housing exists. Local contractors said that three to seven months is required to build a house. Banks in Stillwater County and Billings indicated a willingness to finance homes for members of the Stillwater Project permanent work force if employees can meet loan requirements (Housing Development Associates, 1984, p. 21).

The impact of the project in housing and land values is difficult to predict. Such price impacts would depend on housing supply and demand, which would depend to a large degree on the number of in-migrating employees and the location preferences of such in-migrants. If the company hires 40 percent of its work force locally, and if in-migrants settle as projected in Employment and Income, housing demand could outstrip the supply in the initial years of the project. Housing and land prices could increase initially and then decline under such a scenario. However, if a greater number of local residents are hired by the company, housing demand would not be as great and housing and land values would be more stable.

Project Concerns

Chapter III details the concerns expressed by county residents over the project proposed by Anaconda in 1981. The following discussion addresses the likelihood of the occurrence of those concerns due to the Stillwater Project.

The Stillwater Project would provide an additional 223 jobs. Approximately 89 of these jobs are expected to be filled by persons already living in the county (Stillwater Mining Company, 1984c, p. 8).

It is not known if the cost of living in the county or local areas would rise more during mine construction and operation than it would in other areas of the region. Housing prices could rise initially until the housing supply caught up with new demand. However, if too many housing units were constructed, housing values could fall. Seventy-nine percent of the residents surveyed stated that they thought the cost of housing would be worse if the mine were developed (Entercom, 1981). It is not known if or how much housing prices would rise or fall. Land prices might rise with the development of the project, which could cause difficulty to ranchers attempting to expand their operations.

Ranchers moving cattle along the roads between the minesite and Nye (about 7 miles) would be inconvenienced by the additional traffic generated by the increased population, and by mine and mill workers commuting to work. Increases in traffic also would result in more vehicle accidents and deaths (see Transportation). The traffic could also be viewed by some residents as a reduction in privacy.

Wage rates for ranch workers should not rise as a result of the project. For comparison, between 1970 and 1979 Rosebud County experienced a large increase in mine employment due to coal development. Despite this large increase in mine employment, the average annual income of local farm workers increased at a slower rate than did the income of farm workers statewide (U.S. Department of Commerce 1980a, 1980b, 1981a, 1981b). The level of development in Rosebud County was much greater than the development that would result from the Stillwater Project.

Any potential impacts of the Stillwater Project on the guide and outfitting business are likely to be small. Stewart et al. (Feb., 1982, p. 32) project rapid future increases in already high levels of hunting of the Stillwater elk herd. Tighter hunting controls are likely to be instituted even without the project. The secondary economic effects of outfitting (effects on other county businesses) are also small; despite the loss of jobs caused by tighter controls, no noticeable difference in the overall employment, income and population projections would result.

The project would not cause rapid social change in the county. Nor would the increased population much alter the existing political structure of the county. Newcomers may have different expectations of local government, such as types of services they believe should be provided, but their proportion of the county population would be small, and they would therefore not constitute a threat to existing county government practices. In Absarokee, in contrast to the county as a whole, newcomers would make up 20 percent of the population by 1995; thus they could influence decisions at the local level. The population increase may give current Absarokee residents the feeling that they have less control over matters affecting their community.

Some persons may move to Stillwater County expecting to work at the Stillwater Project. If such persons are not employed by the company, several outcomes are possible. They may leave the area seeking work elsewhere, or they may find another job in Stillwater County. Some current county residents expressed concern that such persons would remain in the county and qualify for public assistance. The likelihood of increased public assistance caseloads is difficult to predict. Unemployed job seekers may have adequate savings to support themselves or may prefer to seek employment elsewhere rather than receive public assistance.

Mine Closure

Following shutdown of the project, a new social setting would arise. The setting would be unlike the setting either before or during mining. The postmining social life would depend on such factors as how well the mine-related population integrated into the community, the postmining mix of "new" and "old" residents, and demographic characteristics of the postmining community.

Out-migration of unemployed workers and their families depends on several factors including the length of time they have been unemployed, the duration and their eligibility for unemployment benefits, their financial status, and emotional ties to the community, family and friends (MacFadyn, 1983, p. 19). It is unknown how many unemployed workers and their dependents would leave the area.

No-Action Alternative

Stillwater County will be influenced more by the proximity of Billings than if the project were constructed. Park City will continue to be a bedroom community for county residents who work in Billings and the majority of county residents will continue to shop for major purchases in Billings.

The county will experience some population growth as more Billings workers settle in Park City; however, the growth will be less than in the early 1970s. The county population will continue to be dominated by persons 55 years and older over the next decade.

The values, attitudes, and ethnic characteristics of county residents will not change much in the next decade. The occupational structure of employed persons will remain relatively stable without new natural resource development.

COMMUNITY SERVICES

The demand for services presented below represents the amount needed in addition to that given in chapter III, that is, the demand added by the population increase arising from development of the proposed project. All project alternatives would cause essentially the same impacts to community services. Differences are noted in the appropriate sections. The information contained in the following discussion is drawn from the Stillwater Mining Company Hard Rock Mining Impact Plan (1985) unless noted otherwise.

The impact plan was structured to address potential impacts to government facilities and services under the original company operating plan which called for higher employment levels in the first two years of the project than those anticipated according to the new-phased development schedule. Total employment levels are still the same in both schedules; however, peak operations employment is reached at a later date in the revised plan. In the impact plan, company-funded mitigations are scheduled according to defined levels of employee in-migration. The project will still cause fiscal impacts, however, the full magnitude of such service and revenue disparities may occur six months to one year later than originally anticipated.

Stillwater County

County services that would be affected by the population increases resulting from the Stillwater Project include administrative services, law enforcement, and social services. Three special districts have been organized to provide county-wide solid waste collection and to fund and operate the Absarokee sewer system, and would also receive impacts from the population increase.

County Administration

Two and one-half additional full-time employees (FTEs) would be needed in the first four years of Stillwater operation. One FTE would be needed to assist the county commissioners. The planning department would require an additional FTE which would decrease to a quarter-time FTE in year five of the Stillwater Project. The county sanitarian would require an additional half-time FTE.

Law Enforcement

The Stillwater County Sheriff's Department would need an additional deputy and an additional vehicle. The additional officer would be needed in the southern portion of the county, probably Columbus or Absarokee, which will receive the majority of the population influx. The operating costs of the jail, county attorney, and justice of the peace would increase in proportion to the in-migrating population. That is, for each new person moving into the county, annual operating costs would rise by an estimated $1.15 for the county jail, $7.00 for the county attorney, and $6.00 for the justice of the peace.

Social Services

Population growth associated with the project is expected to increase the social services workload and create a need for an additional social worker. Annual costs of the county general assistance program are expected to increase from $3.00 to $6.00 per county resident. For other assistance programs the cost is expected to remain constant at $6.60 per in-migrant (Stillwater Mining Company, 1985, p. 20).

Other Services

The per capita cost of other services provided by the county are expected to remain constant. Per capita costs today for the district court are $14.00; for the library, $5.00; for mental health, $2.40; and for alcohol rehabilitation, $3.00. The total cost of each of these services is expected to increase in direct proportion to the number of in-migrating persons. For example, if 100 persons move into the county, annual county mental health costs would increase by $240.00.

Solid Waste Collection

Six additional green boxes would be needed to serve the in-migrating population--four at Absarokee, two in the Nye-Fishtail area, and two to serve the Stillwater Project. No additional collection trips per week are anticipated. Per capita disposal costs would remain constant at an estimated $9.00 per year.

Sewer System

Two rural improvement districts (5 and 7) provide sewer service to Absarokee. Additional treatment capacity (surface aeration and lagoon area) is needed to accommodate projected population growth in Absarokee. Such improvements would require an estimated $200,000 capital outlay and $20,000 in annual operating costs (Stillwater Mining Company, 1985, p. 25).

Absarokee Water Users Association

The existing capacity of the Absarokee water system is adequate to serve 2 to 3 times the existing population (BMML, 1982, p. 9-40). However, if more than the projected 220 persons settle in Absarokee, and if system distribution leaks are not reduced below 125,000 gpd, an additional well or storage will be needed (Jim Tyson, Manager, Absarokee Water Users Associations, pers. com., January 25, 1985). The association has continued to repair the distribution system, allocating $33,000 in 1983 and 1984 for repairs (Ruth De Groat, pers. com., January 10, 1985). Depending on the total population increase and system repairs, existing capacity may be adequate.

Town of Columbus

Government functions and services provided by the town of Columbus that would be affected by the Stillwater Project include law enforcement, street maintenance, recreation facilities, government administration, sewer and water systems.

Law Enforcement

An additional police officer, an additional vehicle, and additional office space would be needed in Columbus to provide 24-hour on-duty law enforcement. Operating costs are assumed to increase for the city attorney at the current per capita rate of $5.67 and for the police court at the current per capita rate of $2.33.

Street Maintenance

Grading, resurfacing, reconstruction, and drainage work would be required on some streets in Columbus. Maintenance and operation costs are expected to increase to about $4,500 annually--about double the amount expected in year 1 of the project (Stillwater Mining Company, 1985, p. 39).

Water and Sewer System

All improvements to the sewer and water systems are necessary to adequately serve the existing residents of Columbus (see Community Services, chapter III). However, Stillwater Mining Company will loan the town an amount sufficient to fund the estimated cost of repairs (Stillwater Mining Company, 1985, pp. 48-49).

Schools

Approximately 20 percent of the enrollment in the Absarokee elementary school (district 52-C) would be attributable to population growth caused by the Stillwater Project. Population in-migration would add 50 new students to the Absarokee elementary school over 10 years. Such an increase would necessitate hiring a principal and up to three and one-half more teachers, depending on the distribution of children among grades K-8 and special education; expanding cafeteria capacity; adding another school bus; hiring a part-time support personnel; and constructing three classrooms (Stillwater Mining Company, 1985, pp. 54-57). If the existing student/classroom ratio (19:1) is preserved, three additional classrooms would be needed.

Twenty-five new students are expected to enroll in the Absarokee High School (district 52) due to Stillwater Project population growth. No additional teachers or classrooms are anticipated to be needed if the existing capacity is judged according to current state accreditation standards (table IV-9), and if students are distributed throughout all grades. However, if the

TABLE IV-9

Montana School Accreditation Standards

Grade	Number of Students Per Teacher[1]	Number of Students Per Classroom
Kindergarten	22	24
Grade 1	20	26
Grade 2	24	26
Grades 3-4	26	28
Grades 5-8	28	30
High School[2]		30

Source: Susan Dandliker, Accreditation Specialist, Office of Public Instruction, pers. com., Dec. 17, 1984; and Board of Education, [no date], pp. 21-22.

[1] Student/teacher ratios are recommended standards and not enforceable.

[2] There are no limits on the number of students per classroom for choral or instrumental classes. Typing and physical education classes are limited to 45 pupils per classroom.

existing teacher/student (1:11) and classroom/student (1:12.4) proportions are maintained, two additional teachers and one additional classroom would be needed.

Enrollment in the Columbus Elementary School (district 6) is expected to increase by 37 to 40 students at the beginning of the Stillwater Project and in later years level off at an increase of 55 to 60 students. Because students would not be split evenly among the grades, one to two additional teachers and up to three additional classrooms would be needed. A half-time cook would also be needed as well as a half-time principal (Stillwater Mining Company, 1985, p. 73).

The Columbus High School (district 6) would undergo an enrollment increase of 25 to 30 students due to Stillwater Project in-migration. Increased enrollment in Columbus High School would require 1 additional teacher and 1 classroom (Stillwater Mining Company, 1985, p. 82).

Eight to ten additional students are projected to enroll in the Nye Elementary School (district 31), and 4 to 6 new students would enroll in the Fishtail Elementary School (district 13) (Stillwater Mining Company, 1985, pp. 80 and 90). Both schools have adequate capacity to absorb the increased enrollments.

The Effects of Mine Closure

The mine and mill are scheduled to close in 30 years, but the operation could close earlier, or close temporarily at any time. Very little would happen to Stillwater County if the project shut down temporarily for a short period. Few people would leave; housing demand would change little; community services would continue at the same level; and social life would go on much as before. When the closure appears permanent, however, lasting changes would take place.

The most significant changes would arise after the county adjusted to the population brought in by the mine. The time needed for the initial adjustment--for the increases in facilities and services--would amount to two to three years. A mine closure could then cause a minor increase in vacant housing units in Columbus. In Absarokee, the increased vacancy rate would be more apparent. How many of the mine-related housing units in Absarokee would be left vacant depends on the type and location of the units and the percentage of the population that departs. Temporary housing, especially mobile homes, would probably be moved by the owners.

Impacts on community services would also be most apparent in Absarokee. The degree to which community services in Absarokee would be affected by closure depends on how the services had been expanded to accommodate the increase in population from the project. For instance, expansion of staff could be easily overcome by simply decreasing employee numbers. Overcoming facility expansion and eventual surplus would be more difficult. Any facilities not dismantled and without alternative uses might increase operation and maintenance costs but not service quality. Although Absarokee is not expected to expand facilities greatly to accommodate the mine, even a small excess of capacity could be a financial burden for the community.

Hard-Rock Mine Impact Payment

Developers of large-scale hard rock mines or associated milling facilities are required by law to prepare a fiscal impact plan describing the impacts that a proposed development will have on units of affected local government (90-6-307, MCA). The plan shall include the estimated number of persons expected to come into the affected area, the increased capital and operating costs to units of local government, and the financial or other assistance that the developer will provide to such governments (90-6-307(1), MCA). Developers are required to pay all increased capital and net operating costs to affected local government units (90-6-307(2), MCA).

State law also contains tax-base-sharing provisions designed to distribute tax revenue among counties, municipalities, and school districts according to the number of mineral development employees living within the jurisdiction. Municipalities may receive a portion of the taxable value not to exceed 20 percent; such portion is to be distributed among municipalities according to the percentage of the total number of mineral development employees living in each municipality. The remaining portion of taxable value must be distributed among each affected county according to the percentage of mineral employees living in each county. High school and elementary districts receive a pro-rata share of the taxable valuation of the hard rock mine according to the percentage of the total number of mineral development students living in each district (90-6-404, MCA).

Stillwater Mining Company and Stillwater County have prepared and approved an impact plan that describes expected impacts to and proposed payments for community services provided by the county, Absarokee, Columbus, school districts, and special districts. Therefore, all impacts except those occurring to the Absarokee Water Users Association and the hospital would be mitigated by Stillwater Mining Company. The plan identifies expected impacts and financial mitigations proposed by the company. The company is responsible for paying all increased net operating and capital costs of units of local government due to the hard rock development (90-6-307(2), MCA). The impact plan identifies a total tax prepayment of $2.3 million (excluding contingent funds) to cover increased costs of providing community services and facilities due to in-migrating mine and mill employees (Stillwater Mining Company, 1985, p. iv).

Hard-Rock Mining Impact Trust Account Payments

Grants and loans from the hard-rock mining impact trust account are available to units of local government when a mining operation has permanently ceased operations or has reduced its full-time equivalent mining work force by 50 percent over the preceding 5-year period (90-6-321(1), MCA) (see Fiscal Conditions). The Hard-Rock Impact Board may award grants and loans to pay for outstanding capital project expenses, to decrease unusually high property tax revenues, and to promote development of new industry or new employment opportunities in the area (90-6-321(2), MCA).

No-Action Alternative

Improvements in some community services will be necessary even without construction of the project. The Columbus and Absarokee elementary schools need expansion depending on the age distribution of future students. Additional containers will be needed for solid waste disposal. A new jail and an additional deputy is needed for the Sheriff's Department. The Columbus and Absarokee water systems need to be upgraded, and the capacity of each town's sewer system needs to be expanded.

FISCAL CONDITIONS

Impacts All Production Systems Have in Common

The proposal and all alternatives would generate nearly the same amount of direct and indirect tax revenue. This similarity would result from equal levels of employment, similar types and amounts of mine equipment, and equal levels of mineral production.

Property Tax Base

The Stillwater Project would add about $3,700,000 to the Stillwater County taxable valuation (Stillwater Mining Company, 1984c, p. 20A). An indirect increase in taxable value of approximately $343,000 would result from residential and commercial property built by in-migrants (Stillwater Mining Company, 1984c, p. 20A). Increases in taxable value would occur gradually over the life of the project, reaching a stable level during the project's sixth year.

Three percent of the gross proceeds of metal mines are subject to property tax (15-6-132(2)(a), MCA). At full production, Stillwater Mining Company would contribute $696,382 in gross proceeds to the taxable valuation or assessed valuation of Stillwater County at current metal prices (table IV-10). Gross proceeds tax revenues would fluctuate with the value of metals.

TABLE IV-10

Annual Production and Gross Value of Minerals

Mineral	Amount (troy ounces)	Value Per Troy Ounce	Total value
Platinum	29,207	$ 275	$ 8,031,925
Palladium	102,465	128	13,115,520
Rhodium	891	1,040	926,640
Iridium	347	475	164,825
Osmium	248	950	235,600
Ruthenium	50	160	8,000
Gold	2,426	301	930,226
TOTAL	135,634		$23,212,736

Source: U.S. Bureau of Mines, 1981; Metals Week, February 11, 1985, p. 5.

It is difficult to predict whether the increased taxable value added by the Stillwater Project would raise or lower the property tax mill levy of the local government jurisdictions affected by the project. Mill levies would depend on the cost of providing services to in-migrating persons and current residents compared to available revenues.

Metalliferous Mines License Tax

The state of Montana would receive an annual license tax from the proposed mine. The tax paid would amount to $86,250 plus 1.5 percent of the gross value of mine's production over $1,000,000 per year, or about $419,441 per year. Over the life of the mine the total tax revenue would amount to about $10,486,025, assuming constant prices and a 25-year mine life. The actual amount would depend on the price of the various metals.

Resource Indemnity Trust Tax

The state levies a tax against all mining in Montana of $25 plus 0.5 percent of the amount of the gross value of the production in excess of $5,000. The tax is paid into the Resource Indemnity Trust Fund, which is intended to provide security against loss or damage to the state's environment from the extraction of nonrenewable mineral resources. The tax from the proposed mine would amount to about $116,063 per year; at current prices and assuming a 25-year mine life, a total of $2,901,592 would be paid into the trust fund.

Impacts Unique to Alternatives 1 and 2

Alternatives 1 and 2 would further increase the taxable value of property of Stillwater County. Each of the alternatives would include construction of a slurry line, which would increase the taxable value of property by approximately $84,000 for alternative 1, and $250,000 for alternative 2 (table IV-11).

TABLE IV-11

Taxable Value of Slurry Lines Under the Proposal and Alternatives 1 and 2

Alternative	Cost to Construct Slurry Line[1]	Taxable Value of Slurry Line	Total Taxable Value
1	$ 763,090	$ 83,940	$3,783,940
2	2,289,270	251,820	3,951,820
Proposal	- 0 -	- 0 -	3,700,000

[1] Value of slurry line ±25 percent.

Mine Closure

A temporary closure of the mine would lower receipts of the gross proceeds property tax, the license tax, and the resource indemnity trust tax. The tax on real personal and commercial property and equipment would remain stable. Total taxes forgone would depend on the length of the shutdown and metal prices.

Permanent closure of the mine would eliminate the gross proceeds, metal license tax, and resource indemnity trust tax proceeds and substantially reduce the real property tax as the company dismantled and/or divested itself of equipment and property. Depending on job availability and out-migration of mine employees, the value of residential and commercial property may change, which would also affect property tax collections.

No-Action Alternative

The taxable value of property in Stillwater County will continue to increase at a slow pace--between 1 to 2 percent annually (including inflation). The number of mills levied will increase also--up to 8 percent annually--depending on the rate of inflation, such increases could be moderate. Total budgeted expenditures will rise over the next 20 years, probably mostly in response to inflationary pressures.

LAND USE

Impacts All Production Systems Have in Common

The proposal and all alternatives would have equivalent land use impacts at the minesite. The area around the minesite is dominated by land disturbed by previous mining (fig. III-18). Reclamation would eventually reestablish adequate vegetative cover to allow use of the area for recreation and wildlife habitat (see Soils, Vegetation, and Wildlife Habitat).

If each of the 165 mine and secondary workers moving into the area build a new home on land currently in agricultural production (average 0.25 acre of land), instead of purchasing or renting an existing house, a total of 41 acres of agricultural land could be permanently removed from production. The total amount of agricultural land converted to new housing development could be less, depending on the location and housing preferences of in-migrants. Such land use conversion would have an insignificant impact on agricultural production in Stillwater County.

Impacts Unique to the Proposal

The proposal would disturb 152 acres of land within the permit area, of which 55 acres are classified as rangeland (table IV-12). Assuming the permit area would be removed from agricultural use during the 30-year life of mine, between 924 and 973 animal unit months (AUMs) of grazing would be lost. The lower number represents the recommended stocking rate under current range conditions. The upper number represents the potential stocking rate under excellent range conditions. Total forgone livestock production would be the least under the proposal.

Impacts Unique to Alternative 1

Under alternative 1, 103 acres of rangeland would be disturbed. Over the life of the project, 1,421 to 1,700 AUMs would be forgone.

Impacts Unique to Alternative 2

Total rangeland disturbance under alternative 2 would be 159 acres. A potential of 1,717 to 2,385 AUMs would be lost during the life of the project.

TABLE IV-12

Acres of Rangeland Disturbed Under Each Alternative and Livestock Production Forgone

Alternative	Acres of Rangeland Disturbed	Per Acre Recommended Stocking Rate[1,2]	AUMs Foregone Over Life of Project[4]	Per Acre Potential Stocking Rate[1,3]	AUMs Foregone Over Life of Project
Proposal	55	.56	924	.59	973
1	103	.46	1,421	.55	1,700
2	159	.36	1,717	.5	2,385

[1] Stocking rates are calculated as a weighted average of stocking rates for each type of rangeland occurring within each alternative by U.S. Soil Conservation Service guidelines (USCS, 1981).

[2] Recommended stocking rate is the number of cattle per month per acre recommended for an area.

[3] Potential stocking rate is the number of cattle per acre which could be grazed assuming the best possible land use management techniques.

[4] AUMs forgone over the life of the project is the number of acres times the stocking rate times 30 years.

No-Action Alternative

Land use in Stillwater County will follow present trends. Agriculture will remain the dominant use; however, conversion of such land to residential uses will continue although at a much slower pace than in the late 1960s and early 1970s. Recreational use of the Stillwater valley will remain an important area land use, and will show moderate increases over the coming 20 years.

TRANSPORTATION

Impacts All Production Systems Have in Common

FAS 419

When the mine and mill are at full production, traffic could increase 159 to 178 ADT (average daily traffic) on FAS 419 from Absarokee to Nye if workers and their families locate as projected in Employment and Income. Such traffic would increase 1980 ADT by 50 percent and 1983 ADT by 61 percent. Traffic increases would be most significant between Nye and Fishtail. Mine-related traffic is projected to be 20 percent of total traffic on FAS 419 by 2000 (Stillwater Mining Company, 1984b, p. 17a).

Based on 1977-80 accident rates (table IV-13), over the 25-year life of the mine there would be an additional 368 accidents on FAS 419. Based on 1980

TABLE IV-13

Current and Projected Traffic

Road Segment	Current Conditions (1980)					Future Conditions (Total for 25 years of Operation)				
	ADT[1]	Accident Rate[2]	Accidents 1977-80	Injuries Rate[3]	Fatality Rate[4]	Net Additional ADT	Net Additional Vehicle Miles[5] (millions)	Accidents	Injuries	Fatalities
FAS 419[6] (Absarokee to Nye Jct.)	437	8.49	86	.48	.015	283	52.6	447	214	7
FAS 419[6] (Nye Jct. to Minesite)	260	1.80	4	.48	.015	153[7]	7.5	14	7	0
FAS 420 (Absarokee to Fishtail)	262	5.31	8	.48	.015	40	2.5	13	6	0
FAP 78[6] (Columbus to Absarokee)	1,014	3.35	99	.48	.015	448	76.9	258	124	4
TOTAL			197					732	351	11

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[1] ADT=Average Daily Traffic [Sources: HKM Associates, 1981, p. 17; 1980, p. 93; and Department of State Lands, 1985].

[2] Accident rate=number of accidents per million vehicle miles [Sources: HKM Associates, 1981, p. 18, figure 3; CDM 1981, p. 2.9-12].

[3] Injuries/accidents, statewide rate, 1980-81. Source: Williams, written com., May 18, 1982.

[4] Fatalities/accidents, statewide rate, 1980-81. Source: Williams, written com., May 18, 1982.

[5] Total net addition of millions of vehicle miles accumulated over 25 years=(average net additional traffic) x (segment length) x (25 years) x (365 days).

[6] Segment lengths: FAS 419 (Absarokee-Nye) 20.4 miles, FAS 419 (Nye-mine) 5.4 miles, FAP 78 (Columbus-Absarokee) 18.8 miles.

[7] Alternative 5 would increase traffic along 419 from the mine to the mill by 100 ore-truck trips per day for a total maximum of 316 net additional ADT. Such an increase could cause 28 more accidents with 13 more injuries than the proposal or other alternatives.

and 1981 statewide rates, (Jack Williams, Chief, Evaluation and Research Bureau, Highway Traffic Safety, Montana Department of Justice, written com., May 18, 1982), 214 people would be injured and 7 would be killed in the additional accidents.

Assuming that road maintenance costs are directly related to traffic volumes, costs would nearly double in the initial years of the project due to the proposed mine. The increased traffic on FAS 419 could hinder the movement of livestock on or across the road and cause added inconvenience for recreational travelers.

Mine-related traffic would necessitate additional repairs to FAS 419 above the amount necessary without the Stillwater Project. Approximately $1.6 million would be needed in addition to the estimated repair cost of $5.5 million without the project (Tomas J. Wing, Resource Engineers and Associates, written com., December 10, 1984).

Stillwater Mining Company has agreed in the hard-rock mining impact plan to fund 20 percent (up to $1,460,000) of the cost of reconstructing FAS 419 (including bridges) if additional federal, state, or other funding becomes available prior to 1990. Between 1991 to 1995, the company would contribute 10 percent (not to exceed $730,000) of the cost of upgrading FAS 419. After 1995 the company will not contribute any special funding (Stillwater Mining Company, 1985, p. 35).

FAS 420

Some minor traffic increases could occur on FAS 420 due to the Stillwater Project. The draft impact plan prepared by Stillwater Mining Company and Stillwater County projects an increase of 40 ADT on FAS 420 due to mine-related travel (Stillwater Mining Company, 1984b, p. 17a). Such an amount would represent a 16.9 percent increase above 1980 traffic counts on FAS 420 and a 21.9 percent increase above the 1983 level.

Over the 25-year life of mine there would be 13 additional accidents on FAS 420 and an additional 6 injuries if projected traffic increases occur.

FAP 78

Average traffic volumes on FAP 78 between Columbus and Absarokee would rise by 448 vehicles, or 35 percent above the 1983 level, assuming that mine workers locate as described in Employment and Income. Based on the 1977-80 accident rates and the 1980-81 statewide injury and fatality rates, over the 25-year life of the mine there would be 258 additional accidents injuring 124 and killing 4 people (table IV-13).

Maintenance costs would increase by about a third in the initial years of the project due to the proposed mine if such costs increase proportionally to traffic volume increases. However, total maintenance costs due to the mine-induced population would decrease as area population increases.

Bridges

Only three of the ten bridges on FAS 419 are rated as good bridges. Traffic related to the Stillwater Project would necessitate $95,900 of repairs to bridges above the amount necessary without the project (Thomas J. Wing, Resource Engineers and Associates, written com., December 10, 1985).

U.S. Forest Service Road 846

FR 846 is used by the public to reach the wilderness trailhead on the West Fork of the Stillwater River, as well as other national forest system lands. The road also provides access to the mine exploration road that leads to the 6,550-level adit.

The access road to the 6,550-level adit is discussed in the Forest Service's Environmental Assessment of the 6,550-level adit (on file with Custer National Forest). Use of the road is not covered in Stillwater Mining Company's current application, but rather in the 1981 exploration operating plan. Continued use of the road during full mine operation would have no adverse affect, provided the road is maintained.

In its present location, FR 846 routes the public through the minesite. In the proposal and all alternatives, the road would probably be relocated. The routing of the relocation would depend on the alternative selected.

Impacts Unique to the Proposal

Approximately 3,000 feet of FAS 419 would be reconstructed because it now passes through the tailings impoundment site (fig. II-2). The road would be reconstructed to meet applicable federal and state criteria (Stillwater Mining Company, 1984c, p. 3.1-17).

A short segment of FAS 419 would be used to transport waste rock and ore to the tailings impoundment or mill (Stillwater Mining Company, 1984c, p. 3.1-17). Haul trucks with 25-ton capacities would be used to haul the waste rock and ore.

Stillwater Mining Company would be required by the Forest Service to improve and maintain the section of FAS 419 used by haul trucks to standards used by the Forest Service and Stillwater County.

Mitigating Measures

- SMC will provide the USFS with specific design information for the relocation sections of FAS 419 and FR 846 for review and approval prior to undertaking construction of the relocated roadways.
- SMC will enter into a road maintenance agreement with Stillwater County for that portion of FAS 419 which is to be used by any ore-haulage trucks with the USFS for that portion of FR 846 similarly used.

- SMC will implement an employee busing or van/car pooling program with a target of reducing the traffic on FAS 419 to 1/3 of the number of vehicle trips that could be expected if each worker commuted individually to the workplace. The results of this program will be reported annually to the U.S. Forest Service and the DSL. In the event that the targeted reduction-in-traffic levels on FAS 419 are consistently not achieved by the busing and car/van pooling program for any year of mine operations and the DSL and USFS determine that additional mitigation measures are necessary, SMC will undertake additional mitigation directed toward achieving the targeted traffic-reduction goal.

Impacts Unique to Alternatives 1 and 2

There would be more traffic delays and disruptions due to pipline construction and maintenance. Traffice increases from maintenance activity, however, would be minor. Increases of traffic during construction would be short term.

No-Action Alternative

Average daily traffic on FAS 419 and FAP 78 will continue to grow between 1.5 to 3.0 percent annually over the next 20 years. Area roads and bridges will need repairs and reconstruction even without the project.

RECREATION

Impacts All Production Systems Have in Common

National Forest and Wilderness Recreation Resources

The local area, including Yellowstone County, supplies about 70 percent of the visitors to the part of Custer National Forest near the Stillwater Project. The addition to this area of 120 in-migrating employee families or about 408 people would not measurably affect regional recreational demands; however, since the addition would occur mainly within 30 miles of the affected National Forest lands, some increased pressure on area campgrounds and dispersed areas would result. This increase could be accommodated within the estimated biological carrying capacity of the area.

The carrying capacities of the national forest lands, however, are finite. They are directly related to the intensity of management. The capacities listed in chapter III (table III-18) are for high intensity management. The Forest Service has found that if the level of management is reduced, the capacity for use without unacceptable biological degradation will be reduced. For example, day-use capacity of the lower Stillwater drainage inside the Wilderness is estimated to be 125 people per day with intensive management. This would be reduced to 75 people per day if wilderness rangers did not patrol the area, enforce local rules, and promote low-impact camping practices. With increased use, National Forest administrative costs would probably rise.

With the exception of holiday weekends, campsites are always available during the summer season. Actual use counts made in July and August in the Rosebud and Stillwater areas indicate only 40 to 60 percent of the existing capacity is being used. Capacity estimates in people-at-one-time (PAOT) made of the roads, roadside areas, and day-use portions of the Wilderness also reveal unused capacity is available. Nevertheless, holiday weekend use reaches capacity now. With the increased use that would be induced by the Stillwater Project, person-to-person contact would increase, both in the campgrounds and in the day-use part of the Wilderness Area around Sioux Charlie Lake on the Stillwater River. Some people would have to seek campsites elsewhere.

Increased use would also put added pressure on the Forest Service to acquire new public access routes to national forest lands, and put pressure on private landowners next to the national forest boundary to allow passage across their land.

The company may construct a worker camp at Stratton Ranch to house construction and mine employees. Residents of the camp may increase use of the national forest lands along the Stillwater River used as fishing access. Forest land north of the Stratton Ranch would also receive increased foot traffic. The Forest Service would request SMC to assist with mitigating any adverse effects on national forest lands.

Additional demands for fuel wood would also result from the increased number of people. At present demand levels, wood supplies are adequate to meet demand.

Recreation Resources Outside Custer National Forest

On lands that are not part of the national forest, the additional highway traffic would reduce the enjoyment of recreationists using the three fishing sites between the minesite and Absarokee; however, use of the Stillwater River for canoeing, rafting, fishing, and kayaking probably would not decrease as a result of the project.

Deterioration of fishing access sites and campgrounds may occur in other ways. Recreationists would have more difficulty finding an uncrowded access site. Restrictions may have to be placed on the length of camping allowed at the sites to deter temporary mine workers from living there. The Montana Department of Fish, Wildlife and Parks would have to rely on the County Sheriff's Department to control additional use (Ray Burnsten, pers. com., March 2, 1982).

The use of commercial dude ranches and outfitters would not be reduced by the project because the area used by outfitters would not be affected. More traffic would pass the dude ranches.

No-Action Alternative

Recreation demand in and adjacent to the project area is expected to grow at a modest rate.

CULTURAL RESOURCES

Impacts All Production Systems Have in Common

Thirteen cultural resource sites located outside the mine permit area could be adversely affected by unauthorized relic collecting or vandalism.

All of the above sites are potentially eligible for listing on the National Register of Historic Places because of their potential to yield information on the prehistory and history of the area. Further evaluation of most of the prehistoric sites would be necessary prior to a formal determination of eligibility. Of the five sites lying on national forest system lands within the study area, three have been determined eligible for the National Register by the Forest Service and State Historic Preservation Office acting under the recent Advisory Council on Historic Preservation rules suspension.

Before approval of the mine permit by the Department of State Lands and approval of a plan of operations by the Forest Service, the agencies are required to inventory and evaluate significant cultural resources within the area of potential impact, and to take measures to minimize or eliminate possible adverse effects (82.4.335, MCA; ARM 26.4.106 (101); and the National Historic Preservation Act, Section 106). Management of significant resources can include avoidance, project redesign, security measures such as posting "no trespassing" signs, or mitigation through data recovery. The Forest Service is responsible for managing cultural sites on lands under its jurisdiction and SMC is willing to take protective measures on its property.

The thirteen cultural resource sites within the study area that are potentially eligible for the National Register of Historic Places are described in tables III-23 and III-24. The buffalo jump (24ST401) and several associated archaeological sites lie close to or are bisected by FAS 419 and could be adversely affected by unauthorized relic collecting. A stone ring site, the Guthrie site (24ST54), is bisected by the road and would receive similar impact. Three homesteads (24ST55, 24ST53, 24ST59) would probably not be affected because they are still occupied. Seven other sites (stone features and structural remains of mining or homestead activities) are outside the permit area, but could be affected due both to the increased number of people in the area and to the lack of fences on property lines.

Eleven cultural sites were discovered that are not eligible for the National Register and would not be affected by mining and related activities. These sites have been recorded and the information from them preserved.

The proposed new access road to the Mountain View Ridge hoist facility would receive a Class III preconstruction cultural resources inventory by a cultural resource consultant holding a valid Special Use Antiquities permit on the Custer National Forest. Any cultural properties discovered would be evaluated for National Register eligibility. Adverse effects to such properties would be mitigated by road realignment or data recovery in consultation with the Forest Service and the State Historic Preservation Office. Stillwater Mining Company has further agreed to post its property with "no trespassing" signs to discourage relic collecting.

How increased commuter traffic would affect vandalism or relic collecting at sites in the Stillwater Valley is difficult to determine. Most of the archaeological sites along this corridor are hard to see (e.g., scattered stone artifacts) and lie on private lands outside the jurisdiction of the Forest Service or SMC. It is likely that mine workers driving FAS 419 would have no greater adverse effect on cultural sites in the valley than the thousands of recreationists who travel the same road each summer.

The Advisory Council on Historic Preservation (ACHP) and Montana State Historic Preservation Office (MSHPO) have concurred with the U.S. Forest Service position that potential effects to cultural sites lying outside the proposed permit area are so slight as to constitute no effect.

The ACHP, MSHPO, and the Forest Service have further agreed that potential National Register-eligible cultural resources in the proposed permit area can be adequately addressed by specific access restrictions and signing measures.

If Stillwater Mining Company exposes previously unidentified sites on National Forest land during excavation and construction, the company is required to (1) cease activities that could further damage the site and (2) notify the U.S. Forest Service. If the company exposes previously unidentified sites off National Forest land, it will halt operations that could damage the site and contact the Department of State Lands and the State Historic Preservation Office.

No-Action Alternative

The thirteen cultural resource sites would be subject to continued weathering and potential vandalism or relic collecting.

AESTHETICS

Impacts All Production Systems Have in Common

Landscape

Waste rock would be used in the construction of staging areas at all mine portals. This waste rock would be white to gray in color and would weather slowly. Although the staging areas would conform to the natural slope of the area, the light-colored waste rock would be highly visible even after reclamation.

Roads constructed to reach the adits would also cause visual intrusion. These routes, bordered by side-casted rocks and earth, would be highly visible on the hillside. Visitors using Forest Service Road (FR) 846 would travel through a disturbed area larger than what exists today. These roads would be located in the VQO (visual quality objective) Retention/High area. The ore haul road would be highly visible in an undisturbed area. The relocation of

FR 846 would have a lesser impact since it would be in the background of major surface disturbance caused by the mine.

The topsoil stockpile would also be highly visible and would contrast with the surrounding area. The stockpile would be removed during reclamation.

Several structures would be added to the landscape. The 70-foot-high crushing facility would stand above the road-user's line of sight from FR 846 and be visible in the middle- and background from points along FAS 419. During reclamation, these structures would be removed.

After cessation of mining the VQO of the area would probably be met. All structures would be removed and the area reclaimed.

Noise

The operation would have five major noise sources (table IV-14). The composite noise level assumes all noise sources are heard simultaneously. Next to the mill, maximum noise levels are estimated to be about 90 dB(A) (decibels).

However, since noise levels decrease rapidly with distance (Loucks, 1973; Eldred, 1971), the noise levels at FAS 419 would be about 46 dB(A). Assuming a background sound level of 50 dB(A) (see chapter III), the total sound level would be about 51.4 dB(A). This small increase in the sound level would not be noticeable to travelers on FAS 419, nor to recreationists in the Absaroka Beartooth Wilderness.

Mitigating Measures

SMC will take measures to reduce the visibility of project operations by planting mixed conifer shelter belts along the west side of FAS 419 and along

TABLE IV-14

Major Sources and Estimated Noise Levels

Source	Estimated Maximum Noise Level 3 Feet from Source (dB(A))	Distance to FAS 419 (feet)	Estimated Maximum Noise Level at FAS 419 (dB(A))
Ventilation Fan, 5,000 Adit Portal	89	450	46
Coarse Ore Storage Area	45	1,000	0
Front End Loader	83	1,000	33
Crushing & Grinding Area	60	1,000	10
Air Compressor Area	70	1,000	20
COMPOSITE	90		46

Source: Stillwater Mining Company, 1984a; Loucks, 1973.

the northern boundary of project operations. Such shelter belts will be planted along the highway and along the northern property boundary in a manner designed to lessen the visibility of project activities from vehicles traveling along FAS 419. In addition, SMC will use natural poles and insulators in constructing the electric transmission line between the mill substation and the Mountain View shaft site.

Noise

If the Department of State Lands determined that nearby residents were adversely affected by increased noise levels, the Department would require Stillwater Mining Company to implement measures necessary to reduce nuisance noise levels.

Impacts Unique to the Proposal

The tailings dam would have the greatest visual impact (fig. IV-3). This structure would be visible in the background, middle ground, and foreground from FAS 419 as the visitor approaches from the north. However, because of the rolling hill topography, the dam would be visible from no more than a mile away on FAS 419. Travelers approaching from the south would not see the dam until they were next to it. The view is blocked by a rocky cliff. The 125-foot-high dam would screen the road and adit disturbances from the view of most travelers on FAS 419. The tailings pond would be visible to visitors using FR 846. After reclaimation the tailings embankment would appear unnatural and the VQO of retention would not be met.

Impacts Unique to Alternative 1

The tailings dam would be 82 feet high. It would be located perpendicular to FAS 419 at the Stratton site. The tailings pond would be in the foreground and middle ground when viewed from the Cathedral Mountain subdivision and in the background when viewed from other residential developments. The slurry pipeline would be buried in the borrow pit of FAS 419 from the mill to the tailings impoundment.

Once constructed, the pipeline would not be noticeably. Both the waste rock dump and emergency tailings pond at the minesite would be noticeable during operation of the mine. The disturbances would be graded, topsoiled, and revegetated after mining and would blend into the natural landscape.

Impacts Unique to Alternative 2

The tailings impoundment would change the visual pattern of the agricultural land at the Hertzler site until reclamation was completed. The tailings impoundment would not be visible from FAS 419, although it would be visible from FAS 420. Visual impacts that are different from the proposal would be similar to alternative 1.

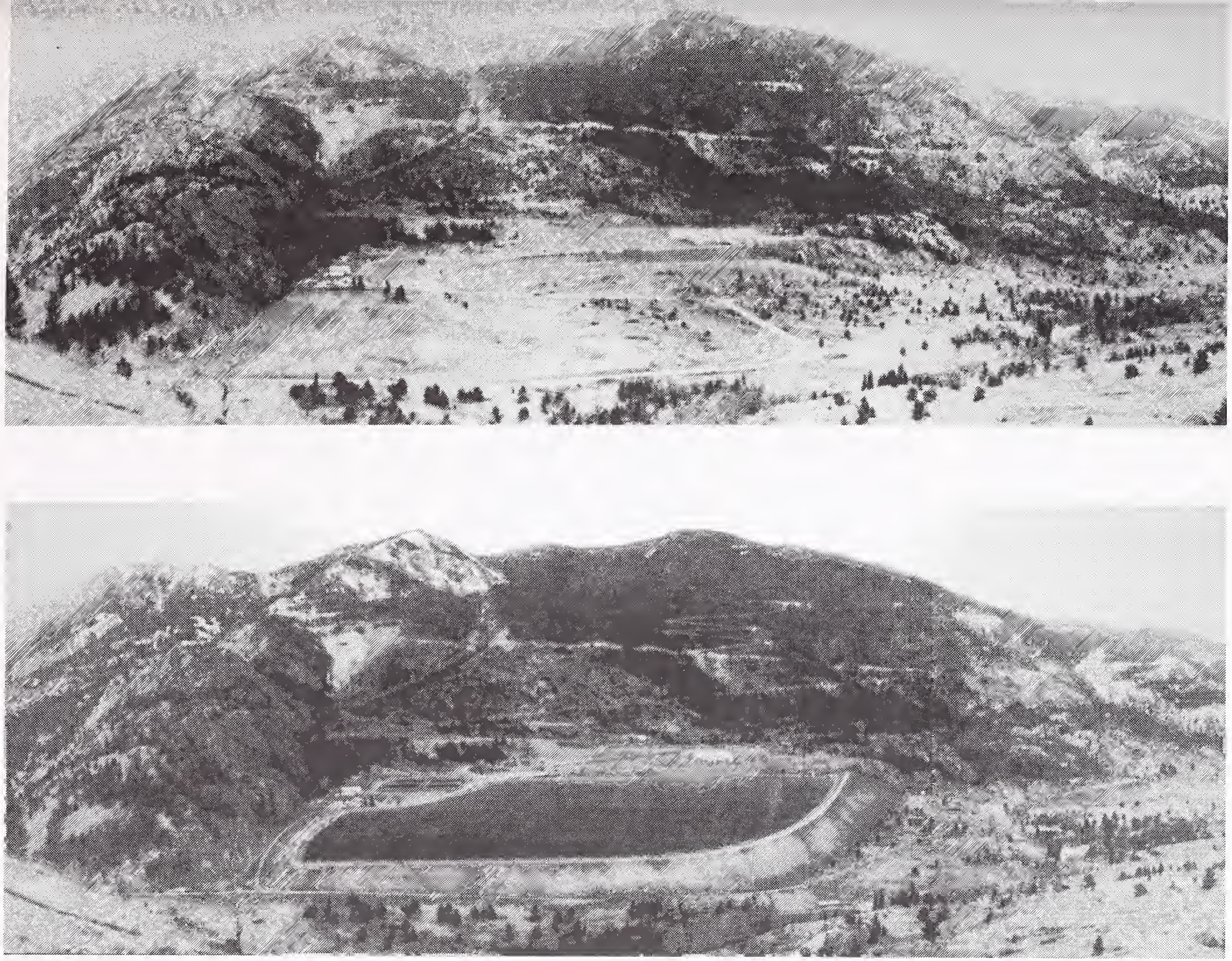

FIGURE IV-3

Retouched photographs show what the area would look like without the project and what it would look like during operation. Note: percolation ponds, tailings embankment and pond, soil stockpile, and mountainside roads to access the portals.

No-Action Alternative

Evidence of historic mining activity would be visible for years. Areas disturbed by current exploration activity would be reclaimed to blend with the surrounding landscape. The old asphalt chromite storage slab, mountainside roads, and chrome tailings would continue to contrast with the surrounding views.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES AND SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY OF THE LAND AFFECTED BY MINING

Stillwater Mining Company would remove 8.3 million tons of platinum-group-metal ore from the Stillwater Complex over 25 years. Some ore would be left owing to its low grade, limits on underground mining technology, and provisions for miner safety. The metal produced would supply about 5 percent of United States demand for platinum and about 20 percent of demand for palladium. The mine would also provide considerable tax revenues, royalties, and jobs. These benefits would be gained at a cost of short-term vegetative, wildlife, and livestock productivity.

The topography of the tailings pond site would be changed permanently. The impounded tailings left after mining would be contoured to drain naturally and would be revegetated. Still, even to the casual observer, the uniform, massive tailings embankment would appear unnatural.

Some native vegetation would be lost during mining. Revegetation would create new vegetation types, but plant diversity and tree and shrub densities would be lowered for decades. Some woody species and some warm-season grass species may be eliminated from the disturbance area. Over the years, both diversity and density would slowly increase.

Revegetation would initially increase livestock forage production. Over the long term, however, forage would decline to near premining levels.

Reductions in long-term vegetative productivity as a result of soil impacts would be minimal or negligible. In the short term, a reduction in vegetative density, diversity, and vigor would probably occur that could last for several years, caused by the loss of soil organic matter, the reduction or loss of soil microorganism populations, and unavoidable impacts on soils.

As long as the mine operates, wildlife would be displaced from the disturbance area. Big game in adjacent areas could be displaced or could experience adverse physiologic effects from nearby disturbance. A golden eagle nest site would probably not be used during or after mining. After the mine closes, revegetation would allow wildlife to return to the area. However, years would be required to return wildlife forage and cover to levels provided by premining, native habitats. Moreover, since Stillwater Mining Company does not plan to replace exactly premining wildlife habitats, original habitats would be lost.

Housing construction would permanently remove an unknown portion of deer ranges. Other indirect impacts (increased traffic and recreation) would decline over the long term if mine closure decreases the local population.

Fishing pressure along the Stillwater River and its tributaries would increase as a result of the population growth stemming from the Stillwater Project. In the long term, fishing pressure from mine-related population would decline, although natural population growth would maintain fishing pressure at relatively higher levels.

Up to 41 acres of agricultural land and wildlife habitat could be converted to residential housing and permanently removed from production. In addition, the power line could remove some land from agricultural and wildlife uses.

Traffic increases could cause 719 additional accidents and 11 deaths.

The increases in numbers of people will cause heavier use of state fishing access points. These will be overcrowded, particularly on weekends, thus reducing the quality of recreation.

The increases in numbers of people would also cause more use of national forest system lands. This would not create a need for immediate expansion or addition of facilities. However as a part of a general increasing trend in population, the overall increase would create the need for expanded facilities at Woodbine Campground, the addition of a new campground along the West Fork of the Stillwater and possibly other areas.

The added traffic caused by mill and mine workers one hour prior to and one hour following shift changes would be a significant impact. The two-lane road between the mine and Absarokee would have a peak load of 75 to 150 cars during that period. This added load on Friday and Sunday afternoons could make driving slow, traffic conditions crowded, and decrease the safety of National Forest users.

IMPACTS OF THE PROPOSAL AND ALTERNATIVES:

-MINE PORTAL ARRANGEMENTS

-POWER ALTERNATIVES

-WEST FORK OF THE STILLWATER ROAD ACCESSES

Three groups of alternatives remain to be analyzed: mine portal arrangements, power-line corridors, and access routes to the West Fork of the Stillwater River. The alternatives described in this chapter can be implemented in any combination, no matter what production system is chosen.

MINE PORTAL ARRANGEMENTS

The agencies and the company have identified three possible portal arrangements.

The proposal:	11 portals
Alternative 1:	2 portals
Alternative 2:	8 portals

Proposed Portal Arrangement

Impacts under the proposed portal arrangement would be greater than under either alternative. The 5,350-, 6,150-, and 6,350-level portals and associated roads (fig. II-2) would require excavation on previously undisturbed slopes. These slopes have been mapped by the company as unstable or potentially unstable. The main concern is rockfalls. The company may need to install cribbing and retaining walls to minimize rockfall on roads and portal sites.

The new roads would also impinge on the large surface failure complex above the minesite. The probability of destabilizing portions of the failure are low (Oriard, 1982). A number of roads cut across this surface failure complex today without any noticeable effects. Even so, precautions should be taken to avoid excessive wetting of any portion of the slide through construction practices that channel or pond water.

Increasing the number of surface openings into and next to the crown pillar could further weaken this zone by opening old fractures and creating new ones. This weakening might increase the chance of crown pillar collapse (see chapter IV, Geology). On the other hand, the additional openings would facilitate mine backfill.

Soil impacts would be similar to those discussed for other parts of the operation (see chapter IV, Soils). A total of about 14 acres of soils, talus, and rock outcrop would be disturbed by the new mine portals and access roads. Since two-lift soil salvage is not proposed, organic matter concentrated in the surface layer of undisturbed soils would be diluted with the subsoil material and lost during salvage. This loss, in combination with the many coarse fragments in the soils and shallow soil depths in the upper elevations, would result in lower postmining water- and nutrient-holding capacities.

During most of the growing season, droughtiness could delay initial revegetation. Although overall precipitation would be greater at the upper-elevation sites than at the tailings site, most of the effective precipitation still occurs between March and June. The droughtiness is evidenced by the sparse vegetation now covering the 6,550-level existing portal area after two growing seasons. Vegetative cover in this area ranges from less than 15 percent to a maximum of about 40 percent. The soils appear to have little or no organic matter. (It should be noted here that, although the revegetation cover was low during the field visit, erosion problems were not observed. This is probably the result of the coarse nature of the soil promoting a high infiltration rate and rapid permeability.)

New roads constructed to serve the various adits would have to be designed in accordance with Forest Service road specifications. Erosion bars, hay bales, and large drainage ditches would be used to minimize erosion off the new roads. Offsite impacts would be negligible.

The amount of water discharging from the new adits would be small and could easily be handled by small-diameter pipes. This water would be either sent to the tailings pond or the sedimentation/percolation pond. No offsite water impacts are expected.

Perhaps the greatest impact of the proposed mine portal arrangement would be visual, although not all portals would be visible from FAS 419 or FR 846. The proposal would result in the construction of nine more portals (in addition to the two existing today). To service these portals, the company would have to build a small yard at each portal opening and construct 1.4 miles of new road, resulting in a zig-zag pattern of cut-and-fill slopes visible from the valley below. The company's 13-kV power line that would serve the Mountain View shaft site and the 11 portals would create a straight 20-foot-wide corridor that would be cleared of vegetation.

Mitigating Measures

o SMC will provide the USFS with engineered plans and typical cross-sections for the design of adit site-yard areas and new adit site-access roads on USFS land for review and approval prior to road or yard area construction.

Portal Arrangement Alternative 1

Portal arrangement alternative 1 would have the least impact on the natural environment. An estimated 9 fewer acres of soils, vegetation, and wildlife habitat would be disturbed. In addition, the 13-kV power line could be sited to avoid a linear configuration. Most of the problems discussed for the proposed arrangement--landslide instability, visual impact, and soil disturbance--would not exist.

Portal Arrangement Alternative 2

Portal arrangement alternative 2 would reduce the visual impact by eliminating most of the new road construction on the mountainside above the mine. Even so, only about three fewer acres would be disturbed overall. Visual impact would be only slightly less than the impact with the proposal, since the portals eliminated in alternative 2 are less visible than the lower portals. The 13-kV power line would have to be sited in a linear corridor to serve the Mountain View shaft site and the intermediate portals.

Alternative 2 would provide 35 additional construction jobs during the construction of an internal ramp made necessary by changing the portal arrangement. Construction of the ramp would require three years (Stillwater Mining Company, 1984a).

No-Action Alternative

Exploration activities by the company would probably continue. As such, surface disturbances associated with the Minneapolis adit and the 6,550-level adit would remain visible until such time as the company completed reclamation. The reclaimed surface disturbances would be distinguishable from surrounding undisturbed areas.

POWER ALTERNATIVES

Three power alternatives are being considered:

Alternative 1: Big Timber to Nye power line.
Alternative 2: Sheep Creek to Nye power line.
Alternative 3: On-site power generation.

Stillwater Mining Company has not proposed a route for the 161-kilovolt power line. Montana Power Company is considering routes in the two corridors above, both starting from the Anaconda-Billings 161-kilovolt line.

Both corridors would have the Nye substation in common and would use the existing Benbow-Mouat 50-kilovolt line from the substation to the minesite. The Benbow-Mouat line would not be upgraded. The Montana Power Company (1984) has provided enough baseline information for a cursory examination of impacts.

More information will be supplied to the Montana Department of Natural Resources and Conservation, which will publish an EIS that examines power-line impacts in detail.

Construction of the power line would last about 7.5 months. Average employment would be 15 persons, with a peak of 25 and a minimum of 3 workers (Montana Power Company, 1984, p. 20). Maximum employment is expected to occur midway through the project. Job categories to be hired include equipment operators, linemen, groundmen, and foremen (Montana Power Company, 1984, p. 20).

Employment and income during construction of the power line would not be significant to the local economy. Due to the short construction schedule and crew size, impacts to community services and transportation would be insignificant. Availability of temporary housing could become strained if power-line construction goes on at the same time as other activities in the county such as oil and gas exploration and construction of the Stillwater Project.

The power line would provide additional property tax revenue to Stillwater County. The installed cost of the line would be $90,000 per mile (1984 dollars) with an appraised value of $7,500 per mile (Montana Power Company, 1984, p. 31). Total tax revenue generated would depend on local mill levies and the total value of the alternative route selected. The length of preliminary routes range from 40 to 46 miles (Montana Power Company, 1984, p. 22).

Power Corridor Alternative 1

In alternative 1, the transmission line would cross 9 perennial streams. Building of towers and roads could introduce sediment to these streams, but reasonable erosion-control methods could be implemented to minimize the impacts. The effect on aquatic organisms and fish would probably be undetectable. The sediment would be rapidly diluted, and the disturbance area would probably be small.

Detailed studies of each corridor will identify high hazard areas such as sites of mass wasting, avalanches, high wind, and water erosion. Such hazardous areas would be avoided or the hazard would be reduced by specific mitigation measures.

Soils information is now limited to erosion potential. When the exact route is chosen, Montana Power Company specialists will gather other soils data, including soil stability and revegetation potential. This more detailed information will then be submitted to the Department of Natural Resources and Conservation.

In alternative 1, the transmission route would cross about 7.2 miles of highly erosive soils. Most of these erosive areas are in natural ephemeral drainages. The topography and geomorphologic features would dictate construction equipment accessibility in these areas. Some erosion and subsequent sedimentation can be expected to occur, especially where temporary roads have to be bladed to allow equipment access. Assuming that reclamation would be concurrent with construction and no severe revegetation problems are encountered, impacts associated with soil erosion would probably be minimal.

The power line would have an 80-foot right-of-way, although the disturbance area would probably be much narrower. The vegetation of the power-line route has not been mapped and revegetation plans have not been submitted. Vegetation disturbance and reclamation plans will be evaluated by the Department of Natural Resources and Conservation when Montana Power Company submits its studies.

Weed infestation along transmission corridors have been a problem in the past. In its application to the Department of Natural Resources and Conservation, Montana Power Company should propose measures to mitigate weed problems.

In alternative 1, the power line would cross mule deer and white-tailed deer winter ranges along the Yellowstone River and Bridger Creek. Although the disturbance area would probably be much narrower than the 80-foot right-of-way, deer would lose some habitat. Other deer may be displaced by the noise and activity of power-line construction. Similar effects on mule deer would be expected during construction across the Limestone winter range. Either substation would remove about 3 acres of white-tailed deer habitat near the Stillwater River.

The Yellowstone River is used as a migration corridor by waterfowl. Collisions with the power line would kill some waterfowl. Power-line poles would remove a small amount of wetland habitat. Collisions between waterfowl and power lines could be reduced by keeping lines below tree line, crossing the river diagonally, and using self-supporting poles (Thompson, 1978).

The power line could run within 1/4 mile of a historic peregrine falcon nesting site. If peregrines again occupy this site, power-line construction would create a potential for nest desertion.

Along the part of the route common to both alternatives 1 and 2, the power line would remove a small amount of deer habitat along the Stillwater River and construction may displace some deer. Upon entering the mine permit area, the power line would be within the Beartooth mule deer range. It would also be constructed along the northern edge of the bighorn winter range. Impacts on sheep and mule deer would be similar to those described in chapter IV, Wildlife.

In general, the design of most power-line pole types would probably prevent raptor electrocutions. Raptor protection would be assured if Montana Power Company would follow the design recommendations of Olendorff et al. (1981).

Depending on the centerline chosen, the power line in alternative 1 would be 40 to 46 miles long. In some cases, agricultural land for example, the right-of-way can be as small as 40 feet. The mileage of each land use crossed by the line is shown in table V-1.

TABLE V-1

Average Miles of Land Use/Cover Crossed

	Irrigated Hay/Grain	Dry Grain	Dry Hay	Irrigated Sub-Irrigated Pasture	Forest[a]	Range
Big Timber Mine	0.8	0.6	0.8	2.2	4.0	34.8
Sheep Creek Mine	0	0.5	0.9	0.2	5.2	36.2

Source: Montana Power Company, 1984.

[a] Forest category includes coniferous, riparian, and rocky areas in southern part of study area.

Eleven cultural resource sites are located near the alternative 1 transmission line route. The six prehistoric sites consist of three stone ring sites, one stone cairn, one cave, and one stone breastwork site. The four historic sites are three homestead remains and a wagon road. Since the centerline location of the transmission line has not been determined, it is not known which of these 11 sites, if any, would be disturbed.

The major visual change from the power line would probably be the new Nye substation. Up to three acres would be required for the substation construction. The substation would be visible to nearby residents and persons traveling FAS 419 and FAS 420 near Nye. Sections of the transmission line would also be visible in the foreground to travelers on Interstate 90, FAS 420, and FAS 419. The line would pass near subdivisions east of Big Timber and would probably be visible in the middleground and background.

Power Corridor Alternative 2

The transmission line in alternative 2 would cross 10 perennial streams. The effect on these streams, as in alternative 1, would probably be negligible.

The alternative 2 route would cross 5.8 miles of highly erosive soils, slightly less than in alternative 1. The problems that would result, as in alternative 1, would probably be minor. The impacts on vegetation, as in alternative 1, cannot be projected until Montana Power Company submits detailed studies to the Department of Natural Resources and Conservation. The problem of weed infestations would be the same in this alternative as in alternative 1.

This alternative would have impacts on wildlife similar to those in alternative 1. The same Yellowstone River deer winter range and waterfowl migration corridors would be crossed. Instead of crossing Bridger Creek deer range, this power line would travel through deer range along Countryman Creek. Mule deer in the Limestone winter range would lose some habitat and may be displaced during construction. More riparian deer habitat would be disturbed than on the other route. The power line would not be close enough to disturb any peregrine falcons that may start using the historic cliff site.

Depending on the exact location chosen, this alternative transmission route would be 42 to 44 miles long. The amount of cultivated land and pasture crossed would be less than in alternative 1 (table V-1).

In this alternative the power line would pass all but one of the cultural resource sites passed by the line in alternative 1. The one site not passed: the stone breastwork site.

In this alternative, the line would be slightly less visible than in alternative 1. Overall, however, the visual impact would be about the same.

On-site Generation--Alternative 3

The impacts to air quality of on-site power generation would be much greater than importing the electricity. The oil-fired power plant would emit about 24 tons of particulate, 293 tons of sulfur dioxide and 127 tons of nitrogen oxides annually (SMC, 1984). The addition of control devices would reduce the particulate and sulfur dioxide emissions substantially. Even with such control devices, the power plant would have a much larger effect on air quality than the mine and mill (see Air Quality, chapter IV).

The power plant would cause more noise than importing electricity. The generating facility would produce a noise level of 80 decibels (dB(A)) near the outside of the plant, even with the installation of noise attenuators (SMC, 1984). Assuming the 80 dB(A) level is measured at 10 feet from the plant, the noise level would decrease to 44 dB(A) at 640 feet from the plant (Loucks, 1973). At that distance the power-generating facility would add little, if any, to the noise from the milling operation.

The potential power-generating facility site has not been specified. However, the stack would probably be highly visible, with the building housing the turbines and generators being less visible, perhaps even hidden by the mill and tailings impoundment.

An on-site generator would disturb an additional 2 acres within the permit area. The site of the generator has not been specified; therefore, vegetation types and wildlife habitats affected cannot be identified. Revegetation methods and results would be similar to those described for the proposed mine. The generator would not noticeably increase impacts on wildlife above those resulting from the proposed mine.

No-Action Alternative

Calculated voltage levels at the current electrical load would be acceptable during both existing normal operating conditions and existing outage conditions. Future electrical loads growth may exceed the existing transmission facilities capacity.

WEST FORK OF THE STILLWATER ROAD ACCESSES

There are two possible routes (fig. I-4) to reach the Forest Service trailhead on the West Fork of the Stillwater River:

Proposal:	via FR 846 (the existing route).
Alternative:	via a reconstructed abandoned road that links FR 140 and FR 846.

Proposed Access Route

The public using FR 846 to reach the trailhead on the West Fork of the Stillwater River could be inconvenienced by mine traffic. The inconvenience would probably be greatest during shift changes. The public could also be temporarily inconvenienced during mine construction and portal blasting, when FR 846 would have to be periodically closed. The blasting and construction would result in a minor safety hazard to the public. Company traffic would introduce the potential for conflict with public traffic.

Stillwater Mining Company would build gates across roads that provide access to the mine portals and facilities. The 5,550-level portal would be the only portal next to FR 846. The yard for the portal would be secured with a fence and gate.

The proposal would allow the public to easily observe Stillwater Mining Company's mining and milling operation from FR 846.

Picket Pin Road Alternative

Conflicts with public use and safety, although minor, would be eliminated by routing the public to the West Fork of the Stillwater River via FR 140 and a segment of reconstructed abandoned roadway. This alternative would, in addition, reduce views of the mine and reduce traffic through the bighorn range next to the minesite.

The reconstructed roadway would lie within the Picket Pin elk winter range. A minor amount of habitat would be lost, but would not affect the elk herd. Substantial traffic increases on the Picket Pin Road (FR 140) are not expected for December through mid-June. Therefore, impacts on wintering elk would not be significant.

The Forest Service estimates the Picket Pin Road alternative would increase traffic on FAS 420 and FR 140 near the historical peregrine falcon cliff complex by approximately eight cars per day from May through November. The additional traffic may effect potential peregrine falcon nest site selection (USDA, 1985).

Additional traffic on FR 140 would increase the county's road maintenance costs. A portion of the maintenance costs would shift from FAS 419 to FR 140.

However, FR 140 is a gravel road with two bridges in poor condition while FAS 419 is a paved road.

Forest users who use the Woodbine Campground as a drop point for trailers would have to travel a longer distance to reach the trailhead at the West Fork. The additional mileage would be about 9 miles. The Picket Pin alternative would provide less opportunities for the public to view the mining and milling operation.

The current landowners of the private land which this alternate route must cross are unwilling to sell the right of way.

No-Action Alternative

Without development of the project, recreational travelers will continue to use Forest Road 486. Recreation traffic will show moderate increases over the coming 20 years.

Chapter VI

APPENDIXES

Development of Project Alternatives--Appendix A

Tailings Pond Siting Study--Appendix B

Flotation Reagents Used in the Tailings Process--Appendix C

Dissolved Constituent Concentrations in Mill Tailings Water--Appendix D

Crown Pillar Stability--Appendix E

Visual Resources System--Appendix F

Common and Scientific Names of Plant Species--Appendix G

Common and Scientific Names of Fish--Appendix H

Common and Scientific Names of Wildlife Species--Appendix I

Ore Reserves and Ownership--Appendix J

APPENDIX A

Development of Project Alternatives

The production system choices were developed using tailings pond locations preferred by the Department of State Lands and U.S. Forest Service.

A tailings disposal site study (Montana Department of State Lands and U.S. Forest Service, 1984) was prepared as the basis for selecting tailings impoundment alternatives (see appendix B). The study identified and evaluated 18 potential tailings pond sites within 7 air miles of the minesite. Eleven of those sites were previously evaluated in a Mountain States Mineral Enterprises (MSME) siting study prepared for the Anaconda Minerals Company (MSME, 1981). The Department of State Lands and the U.S. Forest Service applied various "fatal flaw" and environmental criteria to rate the 18 alternative tailings pond sites. The five highest-ranking sites included Stratton Ranch, the minesite, and three locations at the Hertzler Ranch. Two Hertzler Ranch sites were eliminated because they offered no distinct advantage over the Hertzler site selected by Anaconda Minerals Company in 1982.

Another site, Horseman Flats (M) ranked close to the five best sites. Even so, this site was eliminated from further consideration for a number of reasons:

- The site would result in direct loss of elk winter range, potential disruption of an elk calving area, and some displacement of the elk herd.
- The pond would have to be served by a slurry line, requiring construction of a pipeline on a steep, potentially unstable slope.
- A service road would be required, which would result in added adverse visual impact in the middle ground view from FAS 419.
- Stillwater Mining Company's mill would not produce enough coarse tailings to build the large three-sided embankment that the topography of the site would require.
- Although an earthen dam could be constructed, the cost of the dam, in addition to the cost of pumping tailings up steep terrain, would probably make the site the most costly.

Development of Mine Portal Alternatives

The increase in the number of mine portals (openings) proposed by Stillwater Mining Company is a major change from the plan first proposed by Anaconda Minerals Company. The two alternatives chosen for analysis in this EIS were based on Stillwater Mining Company's consideration of the optimum number of portals and the agencies' consideration of how to clearly reduce visual impact.

Development of Power Supply Alternatives

Montana Power Company (MPC) is studying three main transmission line alternatives as solutions to the voltage problems that would result from the proposed Stillwater Mine load.

(1) Convert the existing Laurel-Mystic-Laurel 40-kV transmission line to operate at 69 kV.
(2) Build a new 100-kV transmission line from the Bridger substation (planned for 1985) to the Stillwater area.
(3) Build a new 161-kV transmission line from the existing Anaconda-Billings 161-kV line to the Stillwater Mine area.

Alternative 1 was dismissed because it would be more costly than either alternatives 2 or 3. Alternative 2 would provide acceptable power for the initial Stillwater Mine load; however, it would not meet unexpected future load demands should either the mine load or residential loads increase. Montana Power Company considers alternative 3 to be the only alternative that would provide acceptable power for the mine load and future load growth in the area. The two alternative 161-kV transmission-line corridors discussed in this EIS are now under study by Montana Power Company.

On-site generation of electricity was chosen as an alternative because it provides a reliable power source without the necessity of constructing a power line.

Development of Road Access Alternatives

The alternative access to the West Fork of the Stillwater trailhead was chosen because it required the purchase of the least amount of private land and would mainly require reconstruction of abandoned roadway.

APPENDIX B

Tailings Pond Siting Study

A preliminary review of aerial photos and topographic maps in the Stillwater project area reveals 18 possible sites for a tailings pond (see table B-1 and fig. B-1). To identify these sites, an interdisciplinary group of scientists and engineers noted depressions, hollows, draws, natural basins, and flat areas, especially where topography would help contain tailings and minimize the size of a tailings dam. The interdisciplinary group than evaluated the 18 sites to decide on the best.

TABLE B-1

Sites Considered

A	Robinson Draw*	J	Mine Site*
B	Hertzler Ranch I*	K	Beartooth Ranch*
C	Hertzler Ranch II*	L	Mountain View
D	Hertzler Ranch III8	M	Horseman Flats I
E	Stanley Coulee*	N	Horseman Flats II
F	Prairie Creek*	O	Cathedral Mountain
G	Stratton Ranch*	P	Buffalo Jump
H	Limestone Cove	Q	Ranch Creek
I	Old Tailings Area*	R	Horseman Flats III

*Sites also considered in MSME (1981) study.

The reason for the tailings site study was twofold: (1) to select feasible tailings pond sites that provide a range of alternatives to Stillwater Mining Company's proposal and (2) to check the findings of the Mountain State Mineral Enterprises (MSME) report commissioned by the Anaconda Minerals Company (AMC). The sites selected through this study are used as alternatives to Stillwater Mining Company's proposal (see chapter I, II, and IV).

In choosing the 18 sites for evaluation, no sites more than 7 miles from the mine were considered, because increasing the number of sites would not add alternatives with greater advantages. Likewise, no sites were identified inside the Absaroka-Beartooth Wilderness, because federal law would probably preclude such siting. In general, sites above 6,500 feet in elevation were not considered because in these areas successful tailings pond construction, operation, and reclamation would be hampered by high moisture, cold temperatures, steep terrain, and fragile soils and vegetation.

EVALUATION METHODS

The 18 sites were evaluated in two steps. In step 1, a "fatal flaw" stage, each site was subjected to four key tests. The sites failings any one

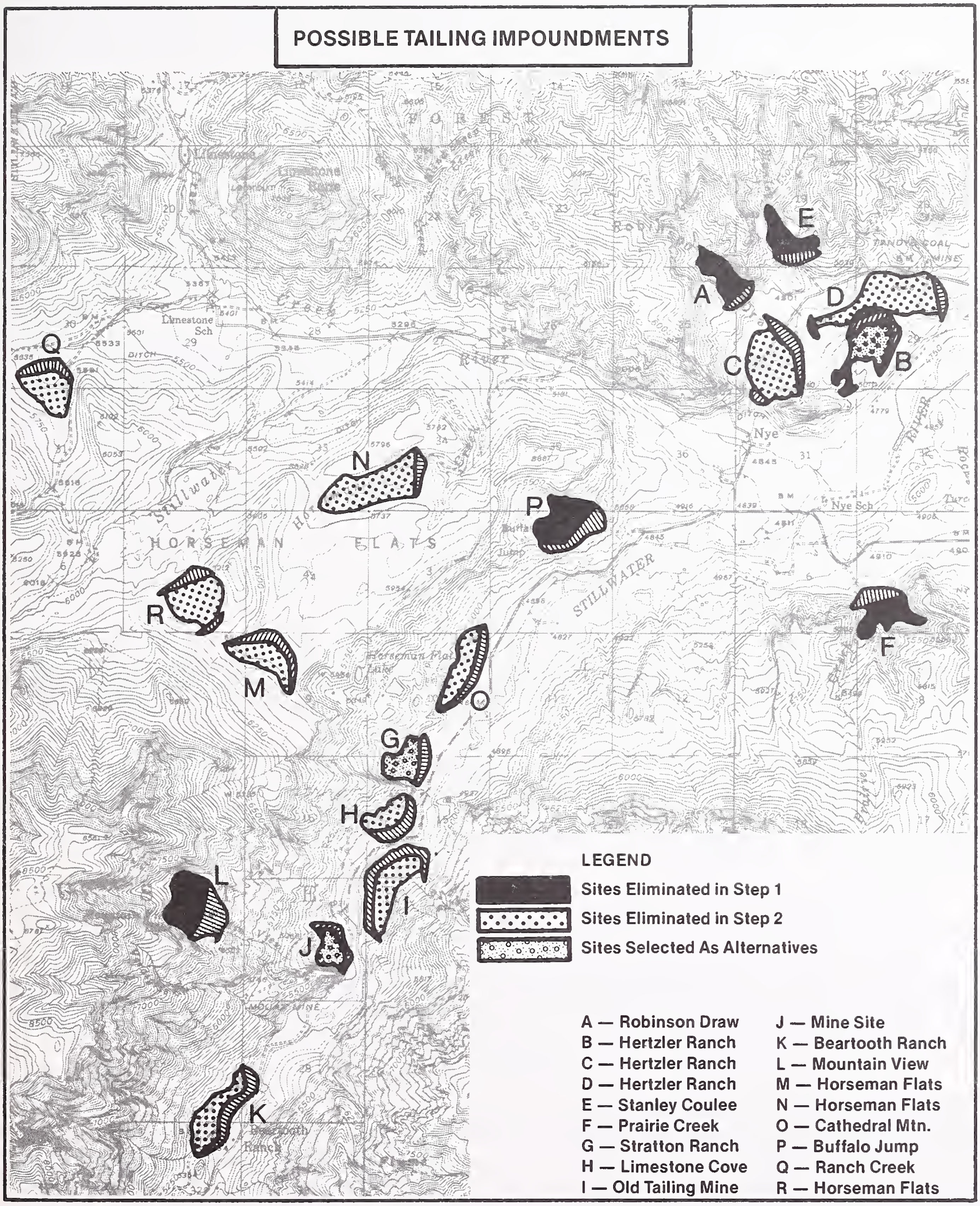

FIGURE B-1

The Department of State Lands and U.S. Forest Service evaluated 18 possible tailings sites. All but 3 sites were ruled out in a two-step selection process.

(or more) of the tests were ruled out as infeasible. In step 2, the feasible sites were rated. Four categories, each broken into parts, were used for the rating.

Step 1

The step 1 tests:

(1) Is the site outside wetlands? No impoundment can be built in wetlands, in accordance with Executive Order (from the President of the U.S.) 11990.

(2) Is the site outside floodplains? No site can be built where floods might cause breaching, piping, or overtopping, resulting in massive erosion during mining or after reclamation. No sites can be located on the 100-year floodplain of the West Fork or main stem of the Stillwater River per Executive Order 11988 and Montana's floodplain program.

(3) Is the site geologically stable? No site can be built where the geology would make long-term stability of the tailings dam, even with elaborate design, questionable.

(4) Would the site be in compliance with all laws? No site can be built where it would violate laws or regulations.

Of the 18 sites, five were eliminated in step 1: Robinson Draw (A), Stanley Coulee (E), Prairie Creek (F), Buffalo Jump (P), and Mountain View (L). (See fig. B-1.)

The wetlands test did not eliminate any site. At Beartooth Ranch (K), however, the impoundment would have to be confined to avoid wetlands (see fig. B-1). At Ranch Creek, the impoundment would contain a small wet area, but past grazing has eliminated the diverse ecosystem that made the site desirable and valuable as a wetland.

The floodplains test eliminated three sites: Robinson Draw (A), Stanley Coulee (E), and Prairie Creek (F). One-hundred-year floods could erode impoundments built at all three sites. The topography at these sites is steep, so diversion ditch grades would probably exceed 10 percent. Grass-lined channels should not exceed 10 percent on easily eroded material such as tailings (Haan and Barfield, 1979).

The geologic stability test eliminated two sites: Mountain View (L) and Buffalo Jump (P). Both sites lie on old landslides. Although the slides appear stable, it is unknown how much tailings they could support. Extensive geotechnical studies, outside the scope of this analysis, would be needed to determine the slides' load-carrying capacities. The Mountain View slide does appear able to withstand some mining (blasting, etc.) without movement being precipitated (Oriard, letter to Anaconda Minerals Company, July 14, 1982). Even so, without further studies, and with stable areas nearby, it is prudent to avoid the Buffalo Jump and Mountain View sites.

The legal test did not eliminate any sites. At Ranch Creek, however, county zoning would require majority consent of adjacent landowners before a nonconforming use, such as a tailings pond, could be approved.

Step 2

For each of the 13 remaining sites, engineers computed the likely impoundment configuration: dam height and volume, pond capacity, and area occupied. It was assumed that each site would hold at least 7 million tons of tailings. The configuration data were used to evaluate the impact that could stem from each site. The 13 sites were then rated using the following categories:

(1) Reclamation potential: (a) How much sandy loam (or finer) soil is available? (b) How high would the quality of postmining soil be? (c) How favorable is the aspect and landform position?

(2) Geologic stability: (a) How much would the impoundment load or remove support from potentially unstable areas? (b) How much subsurface drainage control would be required to maintain stability? (c) How large would the affected unstable area be? (d) How much bedrock geology is present that might promote instability? (e) How adverse are soil characteristics that could destabilize the impoundment?

(3) Runoff Design and Geomorphic Stability: (1) Would 100-year flooding of tributaries during dam life erode the dam? (b) How stable would the 100-year flood routing be after reclamation? (c) Would the impoundment and dam be geomorphically stable in the long term?

(4) Wildlife: How severe would the impacts be on (a) threatened and endangered species; (b) winter range; (c) calving/lambing/fawning habitats; and (d) travel lanes?

(5) Land acquisition: How difficult would it be to acquire (a) the slurry line right-of-way and (b) the tailings pond site?

The following ratings were used for each of the five categories:

0 = essentially no concerns
1 = minor concerns, easily mitigated
2 = moderate concerns, may require special design or mitigation measures
3 = major concerns, successful mitigation questionable

The results of step 2, as judged by the interdisciplinary group, are displayed in table B-2. To arrive at the table B-2 ratings, each question for each category was rated separately. The ratings were combined for the whole category into a composite value, shown in table B-2. The composite values were then totaled. (Note that table B-2 is a summary table. The full rating analysis, a lengthy and complex process, is described and documented in a report that is on file and available for review at the Department of State Lands, Helena, and the U.S. Forest Service, Billings and Red Lodge.)

TABLE B-2

Summary of Step 2: Final Ratings

Site		Ratings					
		Reclamation	Geologic Stability	Runoff Design & Geomorphic Stability	Wildlife	Land Acquisition Considerations	Total
B	Hertzler Ranch I	1	1	1	1	0	4
C	Hertzler Ranch II	0	1	1	1	0	3
D	Hertzler Ranch III	0	2	2	1	0	5
G	Stratton Ranch	1	1	1	0	0	4
H	Limestone Cove	1	1	1	0	3	7
I	Old Tailings Area	2	2	2	2	0	8
J	Mine Site	1	0	0	2	0	4
K	Beartooth Ranch	1	2	2	3	0	7
M	Horseman Flats I	0	1	1	2	2	6
N	Horseman Flats II	0	2	2	3	3	10
O	Cathedral Mountain	1	1	1	2	3	9
Q	Ranch Creek	0	2	2	2	3	9
R	Horseman Flats III	1	2	2	2	3	10

Below is a description of the main concerns at each site.

Sites B and C (Hertzler Ranch)

Total Score: 4 and 3, respectively.
Major Issues: Only minor concerns exist at these sites.

Site D (Hertzler Ranch)

Total Score: 5
Major Issues: Runoff Design. Control of surface water requiring a spillway during mining would pose a moderate problem. After reclamation, a 58-foot-wide, grass-lined diversion channel would have to be constructed across the reclaimed impoundment, requiring earth movement. The long-term stability of such a channel is questionable.

Site G (Stratton Ranch)
Total Score: 4
Major Issues: Geologic Stability. The site would probably require drainage measures, including a blanket drain in the dam, to prevent high ground water from destabilizing slopes. In addition, removal of unstable material or special impoundment design would be required, because about 25 to 35 percent of the site covers unstable landslide materials or potentially unstable slopes with soils that have fair to poor resistance to stress.

Site H (Limestone Cove)

Total Score: 7
Major Issues: Geologic Stability. The site would probably require a blanket drain and perhaps additional dewatering measures because of instability caused by high ground water conditions. About 25 to 40 percent of the area has unstable or potentially unstable slopes, or soils with low strength.

Land acquisition. Stillwater Mining Company would have to acquire private, subdivided land for the pond site. The acquisition might require condemnation.

Site I (The Old Chrome Tailings Site)

Total Score: 8
Major Issues: Reclamation. Rehabilitating the site without bringing in soil from another site would be difficult. More than 75 percent of the area, previously disturbed, lacks original soils. Existing materials have low water- and nutrient-holding capacities.

Water Quality and Geologic Stability. The site is close to the Stillwater River and probably has a high ground water table. This would probably demand special drainage measures to prevent impoundment destabilization. The area covers old tailings that may have a low resistance to stress.

Site J (The Minesite)

Total Score: 4
Major Issues: Only minor concerns associated with selection criteria.

Site K (Beartooth Ranch)

Total Score: 7
Major Issues: Geologic Stability. High ground water conditions, which may cause instability, would probably require drainage measures.

Wildlife. The impoundment would cause significant loss of bighorn sheep winter range.

Site M (Horseman Flats I)

Total Score: 6
Major Issues: Geologic Stability. The site lies close to a large mass wastage scar and over shale bedrock with low mechanical strength and permeability. These conditions would complicate dam construction.

Wildlife. The site would cover elk winter range, disrupt an elk calving area, and displace elk, possibly reducing the elk population.

Site N (Horseman Flats II)

Total Score: 10

Major Issues: Geologic Stability. a 45-foot-wide diversion channel to divert the tributary to Horseman Creek around the pond would be required.

Wildlife. The site would cover elk winter range and calving grounds.

Site O (Cathedral Mountain)

Total Score: 9

Major Issues: Geologic Stability. The dam and pond would abut landslide materials and soils with poor resistance to stress. High ground water conditions, evidenced by small ponds and springs on the slide, would aggravate instability.

Land Acquisition. Acquisition would be difficult, because the site covers private, subdivided land, owned by many people.

Site Q (Ranch Creek)

Total Score: 9

Major Issues: Geologic Stability. The southwest part of the site covers shale bedrock that dips into the site. Soils under the dam area have poor resistance to stress. Possibly high ground water conditions may aggravate the soil instability problems.

Wildlife. Impacts on elk habitat would be similar to those at sites M and N.

Land Acquisition. Acquisition for the tailings pond would violate county zoning regulations.

Site R (Horseman Flats III)

Total Score: 10

Major Issues: Geologic Stability. A moderate amount of earthwork would probably be required to develop a 10-foot-wide grass-lined diversion ditch across the reclaimed impoundment. Heavy flooding could destabilize the channel leading to erosional downcutting.

Wildlife. Impacts on elk would be similar to impacts at sites M, N, and Q.

Sites rated 5 or less--B, C, D, G, and J--are considered acceptable. Sites C and D were eliminated from further consideration because they were similar to site B and offer no distinct advantages. Also, both sites C and D cover productive hayfields which site B does not.

Two sites were thus selected for alternative tailings disposal:

B (Hertzler Ranch)
G (Stratton Ranch)

APPENDIX C

Flotation Reagents Used in Milling Process

Summary of Potential Impacts: After the milling reagents in the tailings slurry leave the mill, they would enter the tailings pond. Based on the following information, the mill reagents would not be expected to present a significant environmental hazard: (1) the expected concentrations of these reagents that would reach the tailings pond would be low, (2) the general toxicity of reagents is low, even at the concentrations that would reach the tailings impoundment, and (3) the amount of tailings water seeping into the ground water would be very small in comparison to the total amount of ground water flowing through the valley.

The Flotation Process

The chemicals Stillwater Mining Company plans to use in the mill flotation process are copper sulfate, potassium amyl xanthate, carboxy methyl cellulose, polypropylene glycol methyl ether, and sulfuric acid. Once the exact milling process is decided on, the company may make some minor changes in the chemicals used; however, the chemicals used would probably be similar in chemical composition to the ones discussed here.

The froth flotation process that Stillwater Mining Company proposes to use is a physical-chemical method of separating and concentrating the metals in finely ground ores. In the process, the crushed ore is mixed with chemicals in a water solution to create conditions favorable for the attachment of desired minerals to air bubbles. The air bubbles carry the minerals--sulfide minerals in this case--to the surface of a slurry pulp. A froth containing the minerals forms at the surface of the slurry and is skimmed off while the other constituents in the ore rock remain submerged (Dow Chemical Company, 1976, p. 2). The froth is then dewatered and sent to a refining plant--Stillwater Mining Company has not yet specified where--for processing to extract platinum-group and other precious metals. The pulp slurry left at the bottom of the flotation cells is piped to the tailings pond for disposal. The froth flotation process would recover over 90 percent of the precious metals from the original ore.

The Function of the Reagents in the Flotation Process

Potassium Amyl Xanthate. This compound is an anionic flotation collector used for sulfide mineral ores. The collector is the most important chemical in the flotation process, since it is the reagent that produces a film on sulfide mineral particles and causes the particles to attach firmly to the rising air bubbles.

Carboxy Methyl Cellulose. This compound is used as a dispersant and to protect certain mineral surfaces against the action of other flotation agents.

This compound helps settle out unwanted tailings, such as clays, which tend to reduce the effectiveness of the flotation process. It also reduces the consumption of the xanthate collector.

Polypropylene Gycol Methyl Ether. This compound is a frothing agent that is used to give a temporary toughness and elasticity to the air bubbles used to float the desirable minerals to the surface. It also lowers the surface tension of the water, much the same way a household detergent works. All the frothers presently in use are organic heteropolar compounds (Dow Chemical Company, 1976, p. 9).

Copper Sulfate. This copper salt is a resurfacing cationic agent that attaches to the metallic minerals such as nickel, cobalt, iron, and zinc sulfide. The copper sulfate cause the metals to attach to the rising air bubbles. Without it, they would not readily attach.

Sulfuric Acid. A dilute solution of sulfuric acid would be used to adjust the pH of the mill slurry.

Concentration of Flotation Reagents in the Tailings Pond

Reagent concentrations in the tailings pond are summarized in table C-1.

TABLE C-1

Estimated Concentrations of Reagents in the Tailings Pond

Reagent	Dosage (lbs/ton processed)	Efficiency Factor (%)[1]	ppm in Tailings Solids	ppm in Tailings Water[2]
Polyglycol Ether	0.06	4-9	0	1.3-2.6
Xanthate	0.09	20-25	6.8-9	0.96
Copper Sulfate (Hydrated)	0.017	20-25	1.3-1.7	0.2
Cellulose	0.56	100	258-263	5-7.4
Sulfuric Acid (Sulfate)	0.43	100	0	(90)

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[1] Percent of reagent "wasted" to tailings pond.

[2] For every ton of tailings milled, 2.333 tons of water would be added diluting reagent concentrations by that amount.

Toxic Potential of the Flotation Reagents

From the estimated concentration of reagents in the tailings pond water (table C-1) the reagent concentration in receiving waters can be calculated.

Assuming five percent of the tailings pond would be unlined, approximately 10 gpm (gallons per minute) would enter the Stillwater River alluvial ground water. (Ten gpm is a high estimate for the amount of seepage from punctures and leaky seams.) If the entire liner were to fail (an extreme case), the maximum seepage rate would be about 200 gpm at all sites except Hertzler Valley. There, seepage would be about 100 gpm because of underlying geologic conditions.

Polypropylene Glycol Methyl Ether. The ground water of the Stillwater River near the mine would contain at most several parts per million (ppm) polyglycol ether beneath the pond. Mixing of seepage water with ground water would lower concentrations to much less than 1 ppm within several hundred feet of the mine. Even if the pond were to completely fail (extreme case) concentrations within one mile of the mine would fall to less than 1 ppm. Laboratory tests on rats indicate this compound is only moderately toxic. The acute oral toxicity level (50 percent mortality) is 3,300 mg/kg (ppm), several orders of magnitude greater than the concentrations that would occur in the pond water, (Dow Chemical USA, 1976, Materials Safety Sheet).

Assuming complete mixing in the Stillwater River concentrations of polyglycol ether would be diluted to several parts per billion (ppb). Results of fish toxicological studies indicate that for freshwater fish acute toxicity levels (LD 50) are greater than 1,000 ppm (Parrish, 1976).

Potassium Amyl Xanthate. The concentration of xanthate in the tailings pond water is estimated to be about 1 ppm. Mixing in the ground water would dilute this to less than 0.1 ppm within several hundred feet of the mine. Acute oral toxicity to laboratory rats (LD 50) is greater than 1,000 mg/kg or ppm (Dow Chemical USA, 1976, Materials Safety Sheet).

Further dilution of seepage water in the Stillwater River would drop xanthate levels to probably less than 1 ppb (parts per billion), even during low flow. In a 28-day test, xanthate was found to be nontoxic to rainbow trout at a concentration of 1.0 ppm (Webb, Ruber, and Ledue, 1976). For daphnia magna, a crustacean, concentrations ranging from 0.1 to 1.0 ppm were found to be toxic (Parrish, 1976). Even if the pond were completely unlined, xanthate concentrations in the river would be one tenth of the lowest toxic level reported for the sensitive Daphnia.

The same general conditions would apply to locating the pond at the Stratton Ranch or Hertzler Valley sites.

Copper Sulfate. Stillwater Mining Company estimates that about 0.017 lbs/ton copper sulfate would be used in the milling process. At that rate 15 to 20 percent would end up in the tailings as insoluble solids and about 5 percent or 0.05 ppm would remain in the tailings liquid. Copper concentrations in the ground water with some mixing would drop to less than 0.004 ppm, safe for domestic (1 mg/l) and agricultural purposes (0.2 mg/l, Montana Ground Water Class I).

In the Stillwater River, copper concentrations would increase by less than 0.05 ppb as long the liner held up and by less than 1 ppb if maximum possible seepage were to occur (an extremely unlikely case). Concentrations of total recoverable copper in the Stillwater River above the West Fork naturally range from less than 2 to 17 ppb (Montana Fish, Wildlife, and Parks, 1977). Based on the average hardness in the river of about 20 mg/l ($CaCO_3$), long-term toxicity may occur in sensitive aquatic life at concentrations as low as 4.4 ppb (U.S. Environmental Protection Agency, 1980).

The mine-induced loading of the Stillwater River would be extremely small and changes could not be detected. The river now appears to be at or above the threshold at which long-term copper toxicity affects may occur and would remain so with or without the mine.

Carboxy Methyl Cellulose. The company proposes to use 0.56 pounds of cellulose for every ton of ore processed. Most of this would report to the tailings pond bound to sediment. The estimated concentration of cellulose in the water would be 3.6 to 4.8 ppm. Dilution would lower this to less than 1 ppm in the ground water near the mine and less than 0.01 ppm in the river. This compound is used as a food additive in such products as ice cream and diet foods. It is considered to be "relatively harmless."

Sulfuric Acid (Sulfate). The company estimates that the maximum usage rate of sulfuric acid (H_2SO_4) would be about 0.43 lb/ton to achieve an optimum process water pH of 8.1. At this usage rate and pH, the tailings pond water would contain about 90 ppm sulfate (SO_4). At these levels, neither the pH nor the sulfates would harm human or aquatic life. Dilution of sulfate in the ground water would lower sulfate concentrations to less than 10 ppm. Sulfate concentrations on the river are normally very low, ranging from 5 to 15 ppm (mg/l).

APPENDIX D

Dissolved Constituent Concentrations in Mill Tailings Waters

Even during extreme circumstances, SMC's mill tailings disposal facility would not adversely affect offsite ground or surface quality. The reasons for this are several:

- The quality of mill tailings water at SMC's mine would probably approximate values listed in table D-1. The results indicate that nearly all dissolved solids and metals in SMC's tailings water would approach water quality criteria or be less than appropriate without further treatment.

- SMC proposes to line the tailings impoundment at the minesite with a synthetic membrane liner to minimize water losses. Even using extreme assumptions (5 percent of area unlined), the loss of tailings water would be small, less than 10 gpm.

- The amount of ground water flowing under the minesite tailings impoundment is estimated to be at a minimum of 1,000 gpm which would significantly dilute (minimum dilution of 100 to 1) any seepage water reaching the ground water system. As such, alluvial water quality would not change as a result of impoundment seepage. Even greater flows in the Stillwater River (minimum about 10,000 gpm) would further dilute pond seepage water preventing changes from occurring downstream of the mine.

A similar assessment would hold for the Stratton Ranch site. The Hertzler valley impoundment probably would not be lined. Instead, an underdrain and pump back system would probably be used to minimize seepage losses to the Hertzler valley. Losses to the Hertzler valley would be at most a few tens of gallons per minute insignificant in comparison to the estimated 600 gpm alluvial ground water flow of the valley.

Table D-1: Estimated Concentration of Dissolved Constituents in Tailings Water Relative to Appropriate Water Quality Criteria (milligrams per liter unless otherwise noted)

	Estimated Tailings Water Quality	Cold water aquatic life (mg/l)	Public water supplies (mg/l)	Irrigation (mg/l)	Livestock watering (mg/l)
Conductivity (umhos/cm)	353			1,800.0	
pH (minimum)		6.5	6.5	4.5	
pH (maximum)	7.94	8.5	8.5	9.0	
Total dissolved solids	355		500.0	1,200.0	10,000.0
Alkalinity	152				
Nitrate as N	0.58		10.0		
Chloride	13		250.0	700.0	
Fluoride	0.19		2.4	15.0	2.0
Magnesium	48			160.0	
Sodium	75			160.0	
Sulfate	90		250.0		
Arsenic	<0.001	0.19	0.0	0.10	0.20
Barium	<0.01		1.00		
Boron	0.23			0.75	5.00
*Cadmium	<0.001	0.00066	0.01		
Chromium III	0.002	0.117		1.0	
Chromium IV	0.005	0.016	0.05		
*Copper	<0.01	0.0065	1.0	5.0	0.5
Iron	0.31	1.0	0.3	20.0	
*Lead	<0.01	0.0013	0.05	10.0	0.10
Manganese	0.012		0.05	10.0	
Mercury	<0.0005	0.000012	0.002		0.010
Molybdenum	<0.1				
*Nickel	<0.01	0.056	0.015	2.0	
Selenium	0.005	0.26	0.01	0.02	0.05
*Silver	<0.01	0.011	0.05		
Zinc	0.007	0.047	5.0	10.0	25.0

*Chronic criteria for water measuring 50 mg/l hardness as $CaCO_3$.

Note: These values were the result of water quality analysis of tailings water produced in a test mill process plant, similar in design to what SMC proposes to use at the Stillwater site. Bench metallurgical tests were conduced by Chevron Resources Company laboratories in Panna Maria, Texas. Ore from SMC's mine was crushed, ground, mixed with deionized/distilled water and milling reagents listed in Appendix C. This slurry solution was subjected to the same type of flotation process SMC proposes to use. Values reported as less than in this table means that actual values were below the detection limit of the laboratory equipment used to analyze the sample.

APPENDIX E

Crown Pillar Stability

Stillwater Mining Company (SMC) proposes to leave a minimum 20-foot-thick crown pillar (undisturbed cap of ore rock) above the underground excavations. Tests of ore strength indicate that over the 20-year life of the mine the crown pillar might be stable and safe for mine workers. But because the pillar is highly jointed (fractured) and the ore rock is susceptible to weathering, the pillar could eventually collapse. This might expose the underground excavation to the surface. Surface subsidence would be minimized over stopes mined with cut-and-fill methods. Backfilling of empty stopes in which tests show incompetent crown pillar would minimize surface subsidence over stopes mined with shrinkage-stoping methods.

SMC has determined, using computer simulations, that destabilizing stresses developing in a 20-foot-thick crown pillar with 60 feet of unconsolidated material on top would average 220 pounds per square inch (psi) and reach a maximum of 500 psi. At 500 psi, the stresses would be less than one tenth of the strength of the solid ore rock (5,900 psi).

These rock strength simulations, however, did not take into account factors such as jointing that reduce the strength of the crown pillar. Using a method described by Bieniaski (in Lama and Vutukuri, 1978), SMC's figures can be adjusted to account for the following strength factors: (1) rock quality (percentage of rock core samples that are hard and sound), (2) spacing of joints, (3) condition of joints, and (4) ground water inflow. The average compressive strength of the crown pillar, incorporating these strength reduction factors, could be as low as 1,000 psi, a 6-fold decrease from the initial compressive calculation of 5,900 psi. (Note: Other methods of determining rock strength have been developed, but the specific information needed to use them was unavailable.)

The safety factor (actual rock compressive strength divided by crown pillar stress [1,000 psi/220 psi]) would therefore probably be about 4 and could be as low as 2 (1,000 psi/500 psi) in the high stress areas of the crown pillar. For underground excavations, a safety factor of 2 to 4 is widely accepted (Ed Van Eechhout, Montana College of Mineral Science and Technology, oral com., March 29, 1983). Recent research indicates a safety factor of 1.5 to 2 is probably sufficient (Peng, 1978, p. 188). The crown pillar would therefore be stable enough to prevent collapse and assure miner safety during the life of the mine.

However, in extreme circumstances, rusting of rock bolts, rotting of timbers, and weathering of the crown pillar over hundreds or more years could cause parts of the crown pillar to collapse.

The breakdown of minerals along joints and fractures would eventually weaken the rock. Pieces of rock could gradually crumble and fall from the lower side of the pillar. The pillar could over time become thinner and thinner from the bottom side up. Stresses within the crown pillar would gradually shift upward, perpetuating periodic caving of the pillar until the entire pillar disintegrated.

Should the pillar collapse, the unconsolidated surficial material above the pillar would fall into the uppermost mine stope, thereby exposing the underground excavations to the surface. The exposed cavity could be up to 20 feet wide, several hundred feet long and about 150 feet deep if the sill pillar holds. Any surface expression of this kind would follow the trend of the proposed surface adits and could take several hundred to thousands of years to develop, although there is a low probability that it could occur in a shorter time period.

Another scenario is that because of the greater stresses at depth, spalling of the hanging wall and footwall would occur over time so that the spalled rock fragments would fill the gap between the walls. This could fill the stopes, stabilize the walls, and prevent further collapse. If the failure occurred in this fashion, the subsidence could occur over a long period and over a large surface area, resulting in a gradual, even lowering of the overall surface.

How long it would take for the crown pillar to fail is unknown, because the thickness of crown pillar material left would vary (with a minimum thickness of 20 feet) and the rate of rock weathering would be variable. Subsidence would never be continuous over the entire length of the underground workings. Five 40-foot-wide vertical support pillars would be left within the 4,800-foot section being mined. Moreover, unconsolidated deposits (weathered bedrock, colluvium, and glacial debris) resting on top of the crown pillar and excavated ore zone would likely ravel into and, in places, fill the hole.

Because the area between the Minneapolis adit and the head frame area is relatively remote and used little for recreation, the danger posed by such cavities would be low.

APPENDIX F

Visual Resources System

Existing Visual Condition

Existing Visual Condition (EVC) is the present state of visual alteration measured in degrees of deviation from the natural landscape (table F-1). To estimate the effects of each Stillwater Project alternative, the predicted future visual condition of the landscape of each alternative must be compared with the existing visual condition.

Visual Absorption Capability

The inherent ability of the landscape to absorb alterations is the visual absorption capability. Land features such as soil type, topography, and vegetative regeneration potential are evaluated to rank the land into high, moderate, or low absorption capability.

Visual Quality Objectives

Landscape management objectives based on the physical and sociological characteristics of an area are visual quality objectives. The objectives refer to the degree of acceptable alteration of the characteristic landscape.

Preservation (P): Ecological changes only, except for very low visual impact recreation facilities.

Retention (R): In general, man's activities cannot evident to the casual forest visitor.

Partial Retention (PR): In general, man's activities may be evident, but must remain subordinate to the characteristic landscape.

Modification (M): Man's activity may dominate the characteristic landscape, but must at the same time utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in middle ground or background.

The visual management system which establishes these VQOs is defined in National Forest Landscape Management, vol. 2, chapter 1, The Visual Management System, USDA Handbook 462.

TABLE F-1

Existing Visual Condition Definitions

CLASS		DEFINITION
EVC 1	Untouched:	Areas of ± 5,000 acres in which only ecological changes have taken place, except for low impact rails and fences.
EVC 2	Unnoticed:	Changes in the landscape are not visually evident to the average person unless pointed out. This also includes low visual impact 2-track trails and roads that may or may not be visible on most aerial photos.
EVC 3	Minor Disturbance:	Changes in the landscape are noticed by the average person, but they do not attract attention. The natural appearance of the landscape still remains dominant. This includes developed pastures and roads and fields not associated with farmsteads.
EVC 4	Disturbed:	Changes in the landscape are easily noticed by the average person and may attract attention. This includes cropland or highly developed hayfields (structural irrigation and canals). Well-designed oil fields are most always included, since their size and influence over the landscape is not entirely mitigable. The natural appearance of the landscape is definitely impacted in fields with well spacing at 160 acres or less.
EVC 5	Major Disturbance:	Changes in the landscape are major and would be obvious to anyone. These changes stand out as a dominating impression of the landscape. Oil fields that are not designed or have no mitigating measures as well as other activities that have major landscape impacts are included.
EVC 6	Drastic Disturbance:	Changes in the landscape are in glaring contrast to the natural appearance. Almost anyone would be displeased with the effect and agree that rehabilitation is required.

APPENDIX G

Common and Scientific Names of Plant Species

Common Name	Scientific Name
Grasses and grasslike	
Idaho fescue	*Festuca idahoensis*
Needle-and-thread	*Stipa comata*
Blue grama	*Bouteloua gracilis*
Little bluestem	*Schizachyrium scoparium*
Western wheatgrass	*Agropyron smithii*
Bluegrass	*Poa* spp.
Japanese brome	*Bromus japonicus*
Bluebunch wheatgrass	*Agropyron spicatum*
Cheatgrass	*Bromus tectorum*
Meadow fescue	*Festuca pratensis*
Redtop	*Agrostis alba*
Intermediate wheatgrass	*Agropyron intermedium*
Timothy	*Phleum pratensis*
Orchard grass	*Dactylis glomerata*
Brome grass	*Bromus* spp.
Sun sedge	*Carex heliophila*
Needleleaf sedge	*Carex stenophylla*
Beaked sedge	*Carex rostrata*
Tule bulrush	*Scirpus acutus*
Spikesedge	*Eleocharis macrostachya*
Prairie sandreed	*Calamavilfa longifolia*
Beardless wheatgrass	*Agropyron inerme*
Sheep fescue	*Festuca ovina*
Canada bluegrass	*Poa compressa*
Green needlegrass	*Stipa viridula*
Creeping foxtail	*Alopecurus arundinaceus*
Forbs	
Silvery lupine	*Lupinus argentus*
Blazing star	*Liatris punctata*
Hood's phlox	*Phlox hoodii*
Rock salaginella	*Salaginella densa*
Silky lupine	*Lupinus sericeus*
Slimflower scurfpea	*Psoralea tenuiflora*
Common dandelion	*Taraxacum officinale*
Red clover	*Trifolium pratense*
Field mint	*Mentha arvensis*
Cutleaf coneflower	*Rudbeckia lacinata*
Cow parsnip	*Heracleum sphondylium*
Meadow aster	*Aster conspicuus*
Wartberry fairybells	*Disporum trachycarpum*
Arrowleaf balsamroot	*Balsamorhiza sagittata*

APPENDIX G

Common and Scientific Names of Plant Species (continued)

Common Name	Scientific Name
Forbs (cont.)	
Spreading dogbane	*Apocynum androsaemifolium*
Field chickweed	*Cerastium arvense*
Loose-flowered milkvetch	*Astragalus tenellus*
White spiraea	*Spiraea betulifolia*
Alfalfa	*Medicago sativa*
Yellow sweetclover	*Melilotus officinalis*
Black medic	*Medicago lupulina*
Purple prairie clover	*Petalostemom purpureum*
Silky lupine	*Lupinus sericeus*
Fringed sagewort	*Artemisia frigida*
Shrubs and trees	
Big sagebrush	*Artemisia tridentata*
Skunkbush sumac	*Rhus trilobata*
Black cottonwood	*Populus trichocarpa*
Balsam popular	*Populus balsamifera*
Quaking aspen	*Populus tremuloides*
Willow	*Salix* spp.
Alder	*Alnus* spp.
Birch	*Betula* spp.
Common chokecherry	*Prunus virginiana*
Red-osier dogwood	*Cornus stolonifera*
Whortleleaf snowberry	*Symphoricarpos oreophilus*
Wood's rose	*Rosa woodsii*
Rocky Mountain maple	*Acer glabrum*
Mountain ninebark	*Physocarpus monogynus*
Creeping juniper	*Juniperus horizontalis*
Douglas-fir	*Pseudotsuga menziesii*
Limber pine	*Pinus flexilis*
Ponderosa pine	*Pinus ponderosa*
Lodgepole pine	*Pinus contorta*
Common juniper	*Juniperus communis*
Kinnikinnick	*Arctostaphylos uva-ursi*
Subalpine fir	*Abies lasiocarpa*
Engelmann spruce	*Picea engelmannii*
Huckleberry	*Vaccinium* spp.

APPENDIX H

Common and Scientific Names of Fish

Common Name	Scientific Name
Brown trout	Salmo trutta
Rainbow trout	Salmo gairdneri
Brook trout	Salvelinus fontinalis
Cutthroat trout	Salmo clarki
Mountain whitefish	Prosopium williamsoni
Longnose sucker	Catostomus catostomus
Mountain sucker	Catostomus platyrhynchus
Longnose dace	Rhinichthys cataractae
White sucker	Catostomus commersoni
Mottled sculpin	Cottus bairdi
Shorthead redhorse	Moxostoma breviceps

APPENDIX I

Common and Scientific Names of Wildlife Species

Common Name	Scientific Name
Mammals	
Elk	Cervus canadensis
Mule deer	Odocoileus hemionus
Bighorn sheep	Ovis canadensis
Dall's Sheep	Ovis dalli
White-tailed deer	Odocoileus virginianus
Black bear	Ursus americanus
Moose	Alces alces
Mountain goat	Oreamnos americanus
Mountain lion	Felis concolor
Deer mouse	Peromyscus maniculatus
Gapper's red-backed vole	Clethrionomys gapperi
Long-tailed vole	Microtus longicaudus
Yellow-pine chipmunk	Eutamias amoenus
Water vole	Arvicola richardsoni
Least chipmunk	Eutamias minimus
Bushy-tailed woodrat	Neotoma cinerea
Beaver	Castor canadensis
Muskrat	Ondatra zibethica
Porcupine	Erethizon dorsatum
Cottontail	Sylvilagus sp.
Snowshoe hare	Lepus americanus
White-tailed jackrabbit	Lepus townsendii
Raccoon	Procyon lotor
Long-tailed weasel	Mustela frenata
Mink	Mustela vison
Striped skunk	Mephitis mephitis
Coyote	Canis latrans
Bobcat	Lynx rufus
Birds	
Peregrine falcon	Falco peregrinus
Bald eagle	Haliaeetus leucocephalus
Golden eagle	Aquila chrysaetos
Northern harrier	Circus cyaneus
Red-tailed hawk	Buteo jamaicensis
American kestrel	Falco sparverius
Rough-legged hawk	Buteo lagopus
Prairie falcon	Falco mexicanus
Western meadowlark	Sturnella neglecta
Vesper sparrow	Pooecetes gramineus
Mourning dove	Zenaida macroura
Blue grouse	Dendragapus obscurus
Ruffed grouse	Bonasa umbellus
Gray partridge	Perdix perdix

APPENDIX I

Common and Scientific Names of Wildlife Species (continued)

Common Name	Scientific Name
Mallard	*Anas platyrhynchos*
Mountain chickadee	*Parus gambeli*
Evening grossbeak	*Hesperiphona vespertina*
Reptiles and Amphibians	
Red-sided garter snake	*Thamnophis sirtalis*
Wandering garter snake	*Thamnophis elegans*
Yellow-bellied racer	*Coluber constrictor*
Prairie rattlesnake	*Crotalus viridis*
Bullsnake	*Pitouphis melanoleucus*
Rocky Mountain rubber boa	*Charina bottae*
Leopard frog	*Rana pipiens*

APPENDIX J

Ore Reserves and Ownership

The ore lies in a geologic zone known as the Stillwater Complex, an igneous rock intrusion about 18,000 feet thick that outcrops for 28 miles in the Beartooth Mountains of south-central Montana. Platinum-group metals appear in a layer, or reef, of the complex that is 0 to 20 feet wide. The reef extends nearly continuously along the entire length of the complex. Claims to the complex are held mainly by three companies: Manville Products Company, AMAX, and Anaconda Minerals Company (fig. II-4).

The complex holds the largest reserve of platinum-group elements known to exist in the United States, an estimated 70 percent of domestic reserves (Dunnet, 1971). According to the National Academy of Sciences, the complex contains more than 125 million troy ounces of platinum-group metals.

The countries that supply most world demand for platinum today are South Africa, the U.S.S.R., and Canada. The Republic of South Africa and the U.S.S.R. together account for 92 percent of world production. Canada produces another 7 percent. South Africa and the U.S.S.R. together possess more than 97 percent of world platinum-group metal reserves (Naldrett and Duke, 1980, p. 1417). The Stillwater Project would supply about 5 percent of the United States' demand for platinum and about 20 percent of the demand for palladium (Les Darling, Stillwater Mining Company, pers. com., September 25, 1984).

The single largest use of platinum-group metals is for automobile catalytic converters. The metals are also used as catalysts in the chemical and petroleum refining industry, in electrical components, in jewelry, in medical and dental work, and in a variety of other manufactured goods (Naldrett and Duke, 1980, p. 1417; Jolly, 1978). The need for these metals in a number of industries derives from their high catalytic activity, inertness over a wide range of temperatures, and high melting points--a combination of properties found in no other metals (Jolly, 1978).

Chapter VII

LITERATURE CITED

Allen, E. B., and M. F. Allen. 1980. Natural reestablishment of vesicular-arbuscular mycorrhizae following stripmine reclamation in Wyoming. Journal of Applied Ecology 17:139-147.

Allen, M. F. 1984. Physiology of mycorrhizae: a key to understanding successful plant establishment. In: VA Mycorrhizae and Reclamation of Arid and Semiarid Lands, eds. S. E. Williams and M. F. Allen. University of Wyoming, Agricultural Experiment Station, Laramie. pp. 69-80.

American Fisheries Society. 1979. A review of the EPA Red Book--Quality criteria for water. R. V. Thurston et al., eds. Bethesda, Maryland: Water Quality Section of American Fisheries Society.

Anaconda Minerals Company. 1980. Application for operating permit: Stillwater platinum-palladium project in Stillwater County, Montana. Denver, Colorado: Anaconda Minerals Company.

Andryk, T. A. 1983. Ecology of bighorn sheep in relation to oil and gas development along the east slope of the Rocky Mountains, northcentral Montana. M.S. thesis, Montana State University, Bozeman, Montana. 100 pages.

Beak Consultants Incorporated. 1982. Land use, recreation, and aesthetics, Technical Report no. 15. Portland, Oregon.

Bear, G. D. 1979. Evaluation of bighorn transplants in two Colorado localities. Fort Collins, Colorado: Colorado Division of Wildlife Special Report 45.

Berg, W. A. 1974. Grasses and legumes for revegetation of disturbed subalpine areas. In: Revegetation of high altitude disturbed lands, eds. W. A. Berg et al., 31-35. Environmental Resource Center Information Series no. 10, Colorado State University, Fort Collins, Colorado.

Bleistein, Sandra. 1978. World market study for important metals of the Stillwater Complex--Chromite, nickel-copper, platinum-palladium. Report prepared for the Beartooth Tri-County Planning Group, Columbus, Montana.

Board of Public Education. [no date]. Standards of accreditation of Montana schools. Page 5.

Botz, M. K. December 12, 1978. Letter to Dr. Loren Bahls of Montana Water Quality Bureau, Helena, Montana.

Boyd, R.J. 1978. American Elk. In: Big Game of North America, eds. J.Z. Schmidt and D.L. Gilbert, II-29. Harrisburg, Pennsylvania. Stackpole Books.

Briscoe, Maphis, Murray, and Lamont, Inc. [BMML]. April 1982. Service and fiscal impact analyses on schools and public service systems: no action and proposed alternative. Draft report prepared for Anaconda Minerals Company. Boulder, Colorado. Prepared for Anaconda Minerals Company. 93 pages. On file at the Montana Department of State Lands, Helena, Montana.

Brown, R. W., R. S. Johnston, B. Z. Richardson, and E.E. Farmer. 1976. Rehabilitation of alpine disturbances: Beartooth Plateau, Montana. In: High Altitude Revegetation Workshop no. 2, eds. R. H. Zuck and L. F. Brown, 58-73. Fort Collins: Colorado State University.

Brown, R. W., and R.S. Johnston. 1978. Rehabilitation of a high elevation mine disturbance. In: High Altitude Revegetation Workshop no. 3, ed. S. F. Kenny, 116-130. Colorado State University, Fort Collins.

Call, M. 1979. Habitat management guides for birds of prey. U.S. Department of Interior, Bureau of Land Management Technical Note 338. 70 pages.

Camp Dresser and McKee, Inc. [CDM]. 1981. Anaconda Stillwater project 12-month environmental baseline report, vol. 1 and 3. CDM Project no. 3139. Wheat Ridge, Colorado.

Camp Dresser and McKee, Inc. 1984. Preliminary air quality modeling for the Stillwater Mining Project. Denver, Colorado.

Carbaugh, B. et al. 1975. Distribution and activity of white-tailed deer along an interstate highway. Journal of Wildlife Management 39(3): 570-581.

Casne and Associates. October 1984. Amended facility plan for Absarokee, Montana. Page 66.

Chae, Yong S. 1978. Effects of blasting vibrations on structures and people. In: Proceedings of U.S. Symposium on Rock Mechanics, 19th ed., ed. Yung Sam King. Reno, Nevada: University of Nevada-Reno.

Christensen, M., and M. F. Allen. 1980. Effect of VA mycorrhize on water stress tolerance and hormone balance in native western plant species. Final report submitted to the Industrial Fund of the Rocky Mountain Institute of Energy and Environment, College of Engineering, College of Arts and Sciences, University of Wyoming, Laramie.

Conn, H. K. 1979. The Johns-Manville platinum-palladium prospect, Stillwater Complex, Montana, U.S.A. Canadian Mineralogist 17:463-468.

Cordell, C. E., and D. H. Marx. 1983. The status and practical application of Pisolithus tinctorius ectomycorrhizae in forest tree nurseries, field forestation, and mine land reclamation--1983. Information paper, Southeastern Forest Experiment Station, Asheville, North Carolina. 3 pages.

Cundell, A. M. 1977. The role of microorganisms in the revegetation of strip-mine lands in the western United States. Journal of Range Management 30:299-305.

Davidson, D. E. 1976. Soil microflora and microfauna. I. Microfungi, mycorrhizal associations and decomposition. In: Final Environmental Assessment, Black Thunder Mine Site, Vol. 2, eds. Bergmand and Marcus. Wyoming Environmental Institute, University of Wyoming, Laramie, pp. VI-1 to VI-17.

Doerr, T. B., E. F. Redente, and F. B. Reeves. 1984. Effects of soil disturbance on plant succession and levels of mycorrhizal fungi in a sagebush-grassland community. Journal of Range Management 37(2): 135-139.

Dow Chemical Company. 1976. Flotation fundamentals and mining chemicals. Midland, Michigan.

Dunnet, Doug. 1977. Views of the Anaconda Company to proposals in the Beartooth face planning unit, Custer-Gallatin-Shoshone National Forest, with particular emphasis to the mineral resource potential of the Stillwater complex. Denver, Colorado. The Anaconda Mineral Company Resource Group.

Elred, K. M. 1974. Assessment of community noise. Noise Control Engineering 3(2): 88-95.

Engineering and Mining Journal, December 1984. Markets. Page 25.

Entercom. 1981. Stillwater county resident survey--tabular data and narrative analysis. Report prepared for Anaconda Minerals Company. Denver, Colorado. 1,008 pages. On file at the Montana Department of State Lands, Helena, Montana.

Everett, R. L. 1980. Use of containerized shrubs for revegetating arid roadcuts. Reclamation Review 3:33-40.

Federal Register. May 19, 1980. EP toxicity test procedure. 45(98): 33127-33129, appendix II.

Fedkenheuer, A. W., H. M. Heacock, and D. L. Lewis. 1980. Early performance of native shrubs and trees planted on amended Athabasca oil sand tailings. Reclamation Review 3(1): 47-55.

Ferguson, R. B., and N. C. Frischnecht. 1981. Shrub establishment on reconstructed soils in semiarid areas. In: Proceedings of Symposium on Shrub Establishment on Arid and Semi-arid Lands, 57-63. Laramie, Wyoming.

Ferrier, G. J. 1974. Bighorn sheep along the lower Colorado River, 1974-2050. Transactions of Desert Bighorn Council 18:40-45.

Finn, W. D. 1980. Seismic response of tailing dams. In: Design and construction of tailing dams, ed. David Wilson. Golden, Colorado: Colorado School of Mines Press.

Fisser, H. G. 1981. Shrub establishment, dominance, and ecology on the juniper and sagebrush-grass types in Wyoming. In: Proceedings of Symposium on Shrub Establishment on Disturbed Arid and Semi-arid Lands, 23-28. Laramie, Wyoming.

Fresquez, P.R., and W. C. Lindemann. 1982. Soil and rhizosphere microorganisms in amended coal mine spoils. Soil Science Society of America Journal 46:751-755.

Geist, V. 1971a. Mountain sheep--a study in behavior and evolution. Chicago and London: University of Chicago Press. 383 pages.

------. 1971b. A behavioral approach to the management of wild ungulates. In: Symposium of British Ecological Society 11:413-474.

------. 1982. On "population control" with reference to mountain sheep and goats. In: Proceedings of Biennial Symposium on Northern Wild Sheep and Goat Council 3:23-24. (Abstr.)

Gerdemann, J. W. 1970. The significance of vesicular-arbuscular mycorrhize in plant nutrition. In: Root Diseases and Soil-Borne Pathogens, eds. T. A. Taussaun, R. V. Bega, and P. E. Nelson. Berkeley, California: University of California Press. pp. 125-129.

HKM Associates. 1981. Feasibility study for the rehabilitation of FAS 419, Stillwater County, Montana. Prepared for Anaconda Minerals Company. Billings, Montana. 92 pages. On file at the Montana Department of State Lands, Helena, Montana.

Hinshaw, Robert F., and Larry D. Prinkki. 1981. Landslide hazards--Anaconda Stillwater Complex Project, Nye, Montana. U.S. Department of Agriculture, Forest Service, Region 1, unpublished technical evaluation.

Horejsi, B. 1976. Some thoughts and observations on harassment and bighorn sheep. In: Proceedings of Northern Wild Sheep Council, 149-155. Cheyenne, Wyoming.

Housing Development Associates. 1984. Stillwater Mining Company Housing Needs Analysis Report prepared for Stillwater County. Billings, Montana. 40 pages.

Howland, A. L., J. W. Peoples, and Edward Sampson. 1936. The Stillwater igneous complex and associated occurrences of nickel and platinum-group metals. Butte, Montana. Montana Bureau of Mines and Geology, miscellaneous contribution no 7.

Hull, A. C., Jr. 1974. Species for seeding mountain rangelands in southeastern Idaho, northeastern Utah, and southern Wyoming. Journal of Range Management 27:150-153.

Hydrometrics. 1981. Hydrological evaluation of a proposed exploration adit, Anaconda Copper Company, Stillwater Project, Nye, Montana. Helena, Montana, unpublished report.

------. 1984. Investigation of the use of percolation ponds for disposal of mine water, Stillwater Mining Company, Nye, Montana. Helena, Montana, unpublished report.

Jackson, C. L. 1982. An update of Urad mine reclamation. In: Proceedings of High Altitude Revegetation Workshop, eds. Cuany and Etra, 79. Workshop no. 5, Colorado State University, Fort Collins, Colorado.

Jackson, Everett, (1968) [reprint 1970]. The chromite deposits of the Stillwater Complex, Montana. In: Ore deposits of the U.S., 1933-1967 (Groton-Sales volume), Vol. 2, ed. John Redige, New York: American Institute of Mining Metallurgists and Petroleum Engineers. pp. 1495-1510.

Jensen, I. B., and R. L. Hodder. 1979. Tubelings, condensation traps, mature tree transplanting and root sprigging techniques for tree and shrub establishment in semi-arid areas. Vol. 2. Montana Agricultural Experiment Station, Montana State University, Resource Report 141. 105 pages.

Jones, W. R., J. W. Peoples, and A. L. Howland. 1960. Igneous and tectonic structures of the Stillwater Complex, Montana. U.S. Geological Survey Bulletin 1071-H, p. 281-340.

Jolly, James H. September 1978. Platinum--Mineral commodity profile MCP-22. Washington DC. U.S. Department of the Interior, Bureau of Mines.

Kay, B. L. 1980. Mulch choices for erosion control and plant establishment. Weeds, Trees, and Turf 19(8): 16-24.

Kerin and Associates, Consulting Engineers. December 1984. Utility expansion plan. 42 pages.

Klohn, E. J. 1980. The development of current tailings dam design and construction methods. In: Design and construction of tailings dams, 1981, ed. David Wilson. Golden, Colorado: Colorado School of Mines Press.

Loma, R. D., and U. S. Vutu Kuri. 1978. Handbook on mechanical properties of rocks, Vol. IV. Clausthal, Germany: Trans Tech Publications.

Larson, J. E. 1980. Revegetation equipment catalog. Vegetation rehabilitation and equipment workshop. USDA Forest Service, Missoula, Montana.

Larson, J. E. 1980. Revegetation equipment catalog. USDA Forest Service Equipment Development Center, Missoula, Montana. U.S. Government Printing Office Stock no. 001-001-00518-5. 198 pages.

Laycock, W. A. 1982. Seeding and fertilizing to improve high-elevation rangelands. USDA Forest Service, General Technical Report INT-120. 19 pages.

Liberta, A. E. 1981. Effects of topsoil-storage duration on inoculum potential of vesicular-arbuscular mycorrhizae. Symposium on Surface Mining Hydrology, Sedimentology. Lexington, Kentucky: University of Kentucky. pp. 45-48.

Lindemann, W. C., D. L. Lindsey, and P. R. Fresquez. 1984. Amendments of mine spoil to increase the number and activity of microorganisms. Soil Science Society of America Journal 48:574-578.

Long, S. G. 1981. Characteristics of plants used in western reclamation. 2d ed. Fort Collins, Colorado: Environmental Research and Technology, Inc. 138 pages.

Loree, M. A. J., and S. E. Williams. 1984. Colonization of western wheatgrass (Agropyron smithii Rydb.) by vesicular-arbuscular mycorrhizal fungi during revegetation of a surface mine. In: VA Mycorrhizae and Reclamation of Arid and Semiarid Lands, eds. S. E. Williams and M. F. Allen, p. 82.. Laramie, Wyoming: University of Wyoming, Agricultural Experiment Station.

Loucks, D. P. 1973. Environmental noise management. In: Models for Environmental Pollution Control, ed. R. A. Deininger, 377-399. Ann Arbor Science Publishers, Inc. Ann Arbor, Michigan.

MacArthur, R. A., D. H. Johnston, and V. Geist. 1979. Factors influencing heart rate in free-ranging bighorn sheep: a physiological approach to the study of wildlife harassment. Canadian Journal of Zoology 57:2010-2021.

MacArthur, R. A., V. Geist, and R. H. Johnston. 1982. Cardiac and behavioral responses of mountain sheep to human disturbance. Journal of Wildlife Management 46(2): 351-358.

MacFedyen, Michael J. 1983. Phase out of coal mining in the Decker study area. Report prepared for Decker Area Mine Comprehensive Social Sciences Study, Montana Department of State Lands and U.S. Office of Surface Mining. Billings, Montana: Mountain West Research-North, Inc. 20 pages.

MacMahon, J. A., and N. L. Warner. 1984. Dispersal of mycorrhizal fungi: processes and agents. In: VA Mycorrhizae and Reclamation of Arid and Semiarid Lands, eds. S. E. Williams and M. F. Allen, pp. 28-41. Laramie, Wyoming: University of Wyoming, Agricultural Experiment Station.

Malloch, D. W., K. A. Pirozynski, and P.H. Raven. 1980. Ecological and evolutionary significance of mycorrhizal symbioses in vascular plants. Proceedings of the National Academy of Sciences [USA] 77:2113-2118.

Marcuson, P. E., P. E. Foennis, and M. Schollenberger. 1982. Stillwater River fisheries investigations. Montana Department of Fish, Wildlife and Parks. 46 pages.

Mautz, W. M. 1978. Nutrition and carrying capacity. In: Big Game of North America, eds. J. L. Schmidt and D. L. Gilbert, 321-348. Stackpole Books, Harrisburg, Pennsylvania.

McKell, C. M. 1982. New developments in soil amendments--a biologist's point of view. In: Proceedings: High-altitude Revegetation Workshop no. 5, eds. R. L. Cuany and J. Etra, 151-163. Fort Collins, Colorado: Colorado State University Information series no. 48.

Menge, J. A., and L. W. Timmer. 1982. Procedures for inoculation of plants with vesicular-arbuscular mycorrhizae in the laboratory, greenhouse, and field. In: Methods and Principles of Mycorrhizal Research, ed. N. C. Schenk, 59-68. St. Paul, Minnesota: The American Phytopathological Society.

Metals Week. February 11, 1985.

Mid-Yellowstone Areawide Planning and Organization. 1978. Other non-point source assessment (draft). Billings, Montana: U.S. Environmental Protection Agency, Section 208. Areawide waste treatment management grant.

Miller, J. F., R. H. Frederick, and R. J. Tracey. 1973. Precipitation-frequency atlas of the western United States. Vol. 1; Montana. Silver Springs, Maryland, U.S. Department of Commerce. 40 pages.

Miller, R. M., and R. E. Cameron. 1976. Some effects of soil microbiota of topsoil storage during surface mining. In: Fourth Symposium on Surface Mining Reclamation Conference and Exposition. II. pp. 184-200. Louisville, Kentucky.

Montana Department of State Lands and Kootenai National Forest. 1978. Draft environmental impact statement--Troy project, Asarco Inc., Vol. 1. Helena, Montana.

Montana Department of State Lands and U.S. Forest Service. 1982. Draft environmental impact statement, Anaconda Stillwater Project, Stillwater County, Montana.

------. 1984. Tailing pond location study, Stillwater Mining Company's Stillwater Project. A technical support document prepared for the Stillwater Project environmental impact statement.

Montana Power Company. 1984. The Stillwater Mining Company 161 kV transmission line project. Report to Montana Department of State Lands.

Mosse, B., and D. S. Hayman. 1971. Plant growth responses to vesicular-arbuscular mycorrhiza. New Phytologist 70:29-34.

Mountain States Mineral Enterprises [MSME]. 1981. Alternate mill/tailing-pond site location study, phase I report. In: Preliminary engineering study: unpublished report to the Anaconda Minerals Company, on file at the Department of State Lands, Helena, Montana.

Naldrett, A. J., and J. M. Duke. 1980. Platinum metals in magmatic sulfide ores. Science, June 27, 1980, 203(4451).

National Research Council. 1977. Medical and biologic effects of environmental pollutants--platinum group metals. Washington, D.C.: National Academy of Sciences. 239 pages.

Nigbor, Micheal, T., Stephen R. Iverson and Paul C. Hyndman. 1985. Environmental Issues Related to Mineral Development in the Stillwater Complex, Montana. U.S. Department of the Interior, Bureau of Mines, Information Circular 9040. 33 pages.

Olendorff, R. R., A.D. Miller, and R. N. Lehman. 1981. Suggested practices for raptor protection on powerlines: The state-of-the-art in 1981. Raptor Research Foundation, Raptor Research Report no. 4. 109 pages.

Oriard, L. L. 1982. Letter to Stephen Dole regarding blasting effects on potential slope failures, on-file report, Custer National Forest, Billings, Montana.

Overton, W. S. 1971. Estimating the numbers of animals in wildlife populations. In: Wildlife Management Techniques, ed. R. H. Giles, 403-455. Washington, D.C.: The Wildlife Society. 633 pages.

Parkinson, D. 1978. Microbes, mycorrhizae and mine spoil. In: Ecology and Coal Resource Development, Vol. 2, ed. M. K. Wali, 634-642. New York: Pergamon Press.

Parrish, L. P. 1976. Environmental Protection Agency letter to Abe Horpsted of Montana Department of Health and Environmental Sciences, on file at Montana Department of State Lands, Helena, Montana.

Peng, Sid. 1978. Coal mine ground control. New York: Wyley and Sons. 449 pages.

Penrose, K. D., and D. J. Hansen. 1981. Planting techniques for establishment of container-grown or bare-root plants. In: Proceedings of Symposium on Shrub Establishment on Arid and Semi-arid Lands, 37-46. Laramie, Wyoming.

Perry, C., and R. Overly. 1977. Impact of roads on big game distribution in portions of the Blue Mountains of Washington, 1972-1973. Applied Research Bulletin no. 11. Olympia, Washington: Washington State Game Department. 38 pages.

Pfister, R. D., B. L. Kovalichik, S. F. Arno, and R. D. Presby. 1977. Forest habitat types of Montana. U.S. Department of Agricultural, U.S. Forest Service, General Technical Report INT-34.

Qamor, Anthony, and Ray Breuninger. 1979. Earthquake hazard to the proposed Northern Tier Pipeline in Montana. In: report no. 4 of the Northern Tier Pipeline Environmental Impact Statement. Helena, Montana: Montana Department of Natural Resources and Conservation.

Raedeke, Linda. 1979. Stratigraphy and petrology of the Stillwater Complex, Montana. Master thesis at University of Washington.

Read, Ransom, R. 1977. Summary report--Mineral development potential of the Stillwater Complex, Montana. Spokane, Washington: Western Field Operations Center, U.S. Bureau of Mines.

Reynolds, P. C. 1974. The effects of simulated compressor station sounds on Dall sheep using mineral licks in the Brooks Range, Alaska. Arctic Gas Biological Report Series, vol. 23. (Abstr.)

Risenhoover, K. L., and J. A. Bailey. 1980. Visibility: an important factor for an indigenous, low-elevation bighorn herd in Colorado. In: Proceedings of Biennial Symposium of the Northern Wild Sheep and Goat Council 1980:18-28.

Rives, C. S., M. I. Bajwa, A. E. Liberta, and R. M. Miller. 1980. Effects of topsoil storage during surface mining on the viability of VA mycorrhiza. Soil Science 129(4): 253-257.

Rost, G. R., and J.A. Bailey. 1979. Distribution of mule deer and elk in relation to roads. Journal of Wildlife Management 43(3): 634-641.

Russell, K. R. 1978. Mountain lion. In: Big Game of North America, eds. J. L. Schmidt and D. L. Gilbert, 207-225. Harrisburg, Pennsylvania: Stackpole Books.

Schuman, G. E., E. M. Taylor, Jr., F. Rauzi, and G. S. Howard. 1980. Standing stubble versus crimped straw mulch for establishing grass on mined lands. Journal of Soil and Water Conservation 35(1): 25-27.

Seed, H. Bolton, Faiz L. Makdisi, and Pedro DeAlbe. July 1978. Performance of earth dams during earthquakes. Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, no. GT7.

Simmons, C., S. Stewart, and T. Butts. 1981. Big game survey and inventory, deer and elk. Region 5 Job Progress Report. Montana Department of Fish, Wildlife, and Parks, Helena, Montana. 121 pages.

Singleton, P. C., and S. E. Williams. 1979. Effects of long-term storage on the fertility and biological activity of topsoil. Final report submitted to the Institute of Energy and Environment, University of Wyoming, Laramie. 36 pages.

Skiba, G. F., and J. L. Schmidt. 1982. Inbreeding in bighorn sheep: a case study. In: Proceedings of Biennial Symposium of Northern Wild Sheep and Goat Council 3:43-53.

Skovlin, J. M. 1982. Habitat requirements and evaluations. In: Elk of North America, eds. J. W. Thomas and D. E. Tower II, 369-413. Harrisburg, Pennsylvania. Stackpole Books.

Snow, C. 1973. Habitat management for unique or endangered species, Golden Eagle. U.S. Department of Interior, Bureau of Land Management Report no. 7, Denver, Colorado. 52 pages.

Spalding, D. J., and J. N. Bone. 1969. The California bighorn sheep of the south Okanagan Valley, British Columbia. British Columbia Fish and Wildlife Branch Wildlife Management Publication no. 3. Vancouver, British Columbia. 45 pages.

Stemp, R. 1982. Heart rate responses of bighorn sheep to some environmental factors. In: Proceedings of Biennial Northern Wild Sheep and Goat Council 3:314-319.

Stevens, D. R. 1982. Bighorn sheep management in Rocky Mountain National Park. In: Proceedings of Biennial Northern Wild Sheep and Goat Council 3:244-253.

Stewart, P. A. 1977. Beartooth-Absaroka wildlife-mining research. Fisheries. Federal Aid to Fish and Wildlife Restoration. Project FW-2-R-5. Montana Department of Fish and Game. 172 pages.

Stewart, S. T. 1975. Ecology of the West Rosebud and Stillwater bighorn sheep herds, Beartooth Mountain, Montana. M.S. thesis, Montana State University, Bozeman. 130 pages.

Stewart, S. T. 1984. Bighorn sheep section of annual Pittman-Robertson report. Unpublished preliminary draft. Montana Department of Fish, Wildlife, and Parks, Helena. 9 pages.

Stewart, S. T., and F. W. Butts. 1982. Horn growth as an index to levels of inbreeding in bighorn sheep. Proceedings of Biennial Symposium of Northern Wild Sheep and Goat Council, 3:68-82.

Stillwater Mining Company. 1984a. Application for an operating permit/plan of operations. Nye, Montana.

------. [and Stillwater County]. 1984b. Stillwater Mining Company Hard Rock Mining Impact Plan. July, 1984.

------. [and Stillwater County]. 1984c. Stillwater Mining Company Hard Rock Mining Impact Plan. September, 1984.

------. [and Stillwater County]. 1985. Stillwater Mining Company Hard Rock Mining Impact Plan. March, 1985.

Stoeckeler, J. H., and P. E. Slabaugh. 1965. Conifer nursery practice in the prairie-plains. U.S. Department of Administration Agriculture Handbook 279. 93 pages.

Stoneberg, R. P. 1977. Beartooth-Absaroka wildlife-mining research. Game. Federal Aid to Fish and Wildlife Restoration Project FW-2-R-5. Montana Department of Fish and Game. 156 pages.

Stroud, R. H. 1967. Water quality criteria to protect aquatic life: a summary. In: A symposium on water quality criteria to protect aquatic life, ed. E. L. Cooper, American Fisheries Society Special Publication no. 4, 33-37.

Thirumai, K., and D. P. Schlick. 1978. Mine safety and health system and challenges in rock mechanics. In: Proceedings of U.S. Symposium on Rock Mechanics, 19th, ed. Yung Som Kim. Reno: University of Nevada-Reno.

Thompson, L. S. 1978. Transmission line wire strikes: mitigation through engineering design and habitat modification. In: Proceedings of Workshop on Impacts of Transmission Lines on Birds in Flight, eds. M. L. Avery and K. D. Hoover, 27-146. U.S. Fish and Wildlife Service Publication FWS/OBS-78/48.

Trappe, J. M. 1981. Mycorrhizae and productivity of arid and semiarid rangelands. In: Advances in food producing systems for arid and semiarid lands, 581-599. New York: Academic Press, Inc.

U.S. Department of Agriculture. 1951. Soil Survey Manual. Agriculture Handbook no. 18. 503 pages.

U.S. Department of Agriculture, Forest Service. 1974. National forest landscape management, Vol. 2. In: Agriculture Handbook 462.

------. 1982. Biological Assessment: Anaconda Stillwater Project. Report by Ronald Escano for Custer National Forest.

------. 1984. Biological Assessment: Stillwater Mining Company Project. Report by John Edwards for Custer National Forest.

------. 1985. Biological Assessment: Stillwater Mining Company Project. Report by John Edwards for Custer National Forest.

U.S. Environmental Protection Agency. 1980. Water quality criteria documents availability. Federal Register 45(231), November 28, 1980.

------. 1975. Inactive and abandoned underground mining--Water pollution prevention and control. Office of Water and Hazardous Materials.

U.S. Fish and Wildlife Service. 1984. Endangered and threatened wildlife and plants. 50 CFR 17.11 and 17.12. U.S. Fish and Wildlife Service, U.S. Department of the Interior. Washington, DC. 24 pages.

U.S. Soil Conservation Service. 1981. Technical range site descriptions. Bozeman: Montana. U.S. Soil Conservation Service, U.S. Department of Agriculture.

Ward, A. L. 1976. Elk behavior in relation to timber harvest operations and traffic on the Medicine Bow Range in south-central Wyoming. In: Proceedings of Symposium on Elk, Logging, Roads. 1976:32-43. Moscow.

Ward, A. L., et al. 1976. Elk behavior in relation to cattle grazing, forest, and traffic. In: Transactions of Norther American Wildlife and Natural Resources Conference, 38:327-337.

Webb, M, H. Ruber and G. Luduc. 1976. The toxicity of various mining flotation reagents to rainbow trout (Salmo Gairdnerii), Water Research, 10:303-306, Great Britain: Pergamon Press.

Wimmler, N. L. 1948. Investigation of chromite deposits of the Stillwater Complex, Stillwater and Sweetgrass Counties, Montana. U.S. Bureau of Mines, report on investigations 4368, p. 41.

Witkind, Irving, J. 1975. Preliminary map showing known and suspected active faults in Western Montana: U.S. Geologic Survey open-file report, p. 75-285.

Wittwer, R. F., S. B. Carpenter, and D. H. Graves. 1980. Effects of hardwood bark, wood fiber and straw mulches on temperature and moisture content of mine spoils. In: Symposium on Surface Mining Hydrology, Sedimentology and Reclamation, 193-197. Lexington, Kentucky.

Wood, T. 1984. Commercialization of VA mycorrhizal inoculum: the reclamation market. In: VA Mycorrhizae and Reclamation of Arid and Semiarid Lands, eds. S. E. Williams and M. F. Allen, 21-27. Laramie, Wyoming: University of Wyoming, Agricultural Experiment Station.

Youmans, H. B., S. T. Stewart, and A. R. Dood. 1982. Upper Stillwater big game technical report. Helena, Montana: Montana Department of Fish, Wildlife, and Parks. 98 pages.

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The Department of State Lands and the U.S. Forest Service appreciate the assistance of Stillwater Mining Company, which provided information on the proposed mine.

REVIEW

The following people from the Department of State Lands and U.S. Forest Service reviewed this document:

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PEOPLE, AGENCIES, AND COMPANIES CONSULTED

The following agencies and companies (other than those cited in the text) provided information used to analyze Stillwater Mining Company's mine plan:

Government Agencies

Montana State Board of Education, Helena (State Historic Preservation Program)

Montana Department of Administration, Research and Statistical Services (Helena)

Montana Department of Commerce, Economic and Community Development Division (Helena)

Montana Department of Commerce, Hard Rock Mining Assistance Board (Helena)

Montana Department of Fish, Wildlife, and Parks (Helena)

Montana Department of Health and Environmental Sciences, Air Quality Bureau and Water Quality Bureau (Helena).

Montana Department of Justice, Highway Traffic Safety Section (Helena)

Montana Department of Highways, Planning and Research Bureau (Helena)

Stillwater County Planning Office (Columbus)

Sweetgrass County Planning Office (Big Timber)

U.S. Army Corps of Engineers

U.S. Department of the Interior, Bureau of Mines, Minerals Availability Field Office (Denver, Colorado)

Nongovernment

Sandra Bleistein, Industrial Economics Division, Denver Research Institute (Denver, Colorado)

Gene Braun, Transmission Engineering Section, Montana Power Company (Butte)

Jim Falvey, Montana Power Company, Butte

Northern Plains Resource Council (Billings)

REVIEW OF THIS STATEMENT

In accordance with environmental law, copies of the draft EIS have been sent to the public for comments and suggestions. All comments will be carefully considered in the preparation of the final EIS. Comments on the draft EIS can be sent to Commissioner Dennis Hemmer, Montana Department of State Lands, Capitol Station, Helena, Montana 59620.

The draft EIS is available for review in the following places:

Montana Department of State Lands, 1625 11th Avenue, Helena, Montana.

Custer National Forest, Supervisors Office, 2602 1st Avenue North, Billings, Montana.

Custer National Forest, Beartooth Ranger District, Red Lodge Ranger Station, Red Lodge, Montana.

Parmley Billings Public Library, 510 North Broadway, Billings, Montana.

Stillwater County Library, 400 3rd Avenue North, Columbus, Montana.

A limited number of copies are available on request from the Department of State Lands, Capitol Station, Helena, Montana 59620 and the U.S. Forest Service, P.O. Box 2556, Billings, Montana 59103.

Chapter IX

COMMENTS ON THE DRAFT EIS

- Letters to the Department
- Answers to the Public

The agencies received 41 letters commenting on the EIS. In addition, at the public hearing held in Absarokee, 5 persons presented verbal testimony. Starting on the next page, this chapter reproduces each letter and testimony in full. Alongside each letter and testimony are the agencies' answers.

Letter 1	Paul and Juanita Wells
Letter 2	Anne Baker
Letter 3	Mrs. Dolores Anstett
Letter 4	James Emerson
Letter 5	Mr. and Mrs. Gary O. Borland
Letter 6	Harris C. Olson
Letter 7	Department of the Air Force
Letter 8	John & Carolyn Mouat
Letter 9	U.S. Department of Housing and Urban Development
Letter 10	Montana Department of Highways
Letter 11	Eva M. Landan
Letter 12	Ed Coughlin
Letter 13	Richard Porter
Letter 14	Sam Carson
Letter 15	Ralph G. Young
Letter 16	U.S. Environmental Protection Agency
Letter 17	Vicki Gill King
Letter 18	Hilmer Wyler
Letter 19	Mark S. Rider
Letter 20	John and Donna Hjelvik
Letter 21	U.S.D.A., Soil Conservation Service
Letter 22	Judith Degele
Letter 23	Montana Chamber of Commerce
Letter 24	Paul & Kathy Donohoe
Letter 25	U.S. Department of the Interior, Office of Environmental Project Review
Letter 26	Stillwater Mining Company
Letter 27	Mary Donohoe
Letter 28	Joe W. Floyd
Letter 29	Montana Department of Fish, Wildlife & Parks
Letter 30	James G. Milligan
Letter 31	Stillwater Protective Association
Letter 32	Billings Rod and Gun Club
Letter 33	County of Stillwater, Board of County Commissioners
Letter 34	Montana Department of Natural Resources and Conservation
Letter 35	Noel and Penny Keogh
Letter 36	Marilee and Ron Harakal
Letter 37	Torian Donohoe
Letter 38	Stephen A. Doherty

Letter 39	U.S. Department of the Interior, Geological Survey
Letter 40	Council on Historic Preservation
Letter 41	Montana State University, Institute of Natural Resources
Testimony 1	Francis Wolcott
Testimony 2	John Mouat
Testimony 3	Gerald Evans
Testimony 4	Red Dutcher
Testimony 5	Grover Rickman

LETTER #1

RECEIVED
APR 24 1985
STATE LANDS

April 23, 1985
328 Windsor Cir N
Billings, Mt. 59105

Kit Walther
Dept. of State Lands
Capitol Station
Helena, Mt. 59620

Dear Kit,

We are writing concerning the proposed mining and milling of platinum and palladium proposed in the Stillwater Valley by the Stillwater Mining Co.

The Impact statement implies that over a thirty year period the proposed project would destroy 97 acres of vegetation and 68 acres of already disturbed area land.

In our opinion this is a drop in the bucket and would be hardly noticed. There are thousands upon thousands of acres of beautiful land all around this area that can be enjoyed by us and many other people searching for beauty.

The jobs are badly needed in this day and age. People should be made to realize the number of related jobs that the 223 permanent jobs would create. This project would make a very positive impact on the Absarokee, Nye and Columbus area, as well as Laurel and Billings area. Lets consider the benefits to the area and to Montana as a whole.

Granted, there would be more municipal and County expenses as a result of increased population. The mining Company would undoubtedly be paying taxes to defray

Thank you for your comments.

LETTER #1

some of the expenses. It may also be possible that they may prove to be excellent neighbors.

Lets look at the positive side of industry for a change instead of driving them overseas by outrageous wages and environmental demands. We should be grateful for the input of industry into Montana. Lets invite more in rather than making it difficult or impossible for industry to come to this state which is sorely underpopulated both by people and industry. We need jobs in Montana for those here now and for our future generations of this state.

It is nice to be able to look at beautiful scenery. It is even nicer to have a dollar in our pocket provided by jobs & healthy economic environment.

Again, 165 acres is not going to be noticed in so large an area, people can adjust to the impact, and we can have more income and tax revenue in the state.

Please consider this a vote for mining in the area and a vote against the miniscule negative impact on the area.

Sincerely,
Paul Wells
Juanita Wells

LETTER #2

4-21-85

Kit Walther
Dept. of State Lands
Capitol Station
Helena, MT. 59620

RECEIVED
APR 23 1985
STATE LANDS

Dear Mr. Walther:

I consider the enclosed article a "threat" to my rights as a tax paying resident/business owner of Absarokee - Stillwater County - Montana. I feel this is a prejudiced account written by an outsider. I do not feel that Kim Larsen's opinion is consistent with the opinion of the majority of local residents. I doubt seriously that the Impact Statement said in regard to fishing "Poaching would increase by an unknown amount". and in regard

(over)

The statements you have underlined in Kim Larson's article and attached to your letter are not the assumptions or opinions of the Billings Gazette's staff writer. The underlined statements were taken from the agencies' draft Environmental Impact Statement. The title of the Gazette's article, however, inaccurately describes the article's contents and the agency's conclusions in the draft Environmental Impact Statement.

The underlined statements, when reviewed out of context, offer an incomplete analysis. Please see pages IV-9, IV-10, IV-30, IV-31, IV-38, IV-39, and IV-51 through IV-54 of the draft EIS for a complete analysis.

LETTER #2

to population increase " As a result, some current Absarokee residents would have less influence over community matters;" I have underlined other statements that may or may not be outlined in the report but are only assumptions or opinions and not *fact*.

Our community *needs* a payroll — we *need* to have a means to keep some of our young people at home — we *need* to have a means to pay our teachers and continue to operate a good school system. We have had experience with a mine operating in our community and we are not blind to the adverse effects. I feel local residents that have to *work* for a *living* share *my opinion*!

Thank you —

Anne Baker
Stillwater Lodge Owner —

LETTER #2

Page 1
Billings Gazette 4-20-85

Mining threatens wilderness aesthetics

By KIM LARSEN
Of The Gazette Staff

Mining and milling of platinum and palladium proposed in Stillwater Valley would significantly harm the aesthetics of the area just north of the Absaroka-Beartooth Wilderness, says a new report.

And employment and population would increase, putting pressures on community services, according to the draft environmental-impact statement issued this week by the Montana Department of State Lands and the U.S. Forest Service.

The 30-year project by Stillwater Mining Co. would destroy 97 acres of vegetation and 68 acres of previously disturbed land, the report said.

Fish would not be directly affected by mining, but increased population caused by mining job opportunities would increase fishing on the Stillwater River and its tributaries.

Increasing population also would affect hunting and other recreation. Poaching would increase by an unknown amount.

The two agencies that prepared the draft statement are seeking public comments before a final report is prepared.

Mailed comments must be postmarked by June 17 and can be sent to Kit Walther, Department of State Lands, Capitol Station, Helena, Mont. 59620.

A public hearing is scheduled 7 p.m. May 15 in the Absarokee High School gymnasium.

The draft statement said the mining venture would add 223 permanent jobs in Stillwater County. About 89 of these would be filled by local residents.

Annual wages paid at the mine would range from $14,500 to $50,000.

The populations of Absarokee and Nye would increase by as much as 25 percent, according to the report. As a result, some current Absarokee residents would have less influence over community matters.

Population increases caused by the mining would add 510 persons to Stillwater County.

(More on Mining, Page 12A)

Mining

From Page One

The county's community services and the sheriff's office would need additional workers to meet increasing demands.

"Expansion of the Absarokee sewer system, additional solid waste containers, expansion of the Columbus water system and sewer system, and an additional deputy in the Columbus Police Department would also be needed to accommodate increased population," the report said.

Most area schools would require more teachers and classrooms, it said.

Mining-related travel would increase traffic volumes on area roads, resulting in more accidents and road-maintenance costs.

Ranchers, recreation travelers and wildlife would be adversely affected by the increased traffic, the report pointed out.

Both national forest and private lands along the Stillwater River would experience increased recreational use.

This could put more pressure on the Forest Service to gain new public access routes to Custer National Forest.

Although no cultural resource sites would be directly harmed by the mining, the report noted that 14 sites that are potentially eligible for the National Register of Historic Places would be indirectly damaged by increased vandalism or relic collecting.

The two agencies proposed some alternatives that they said would reduce the impact in some areas such as hydrology and vegetation.

But the alternative proposals would not change the impact on employment, recreation, community services, transportation, and population growth.

The mining company proposed building a tailing impoundment near the Stillwater River.

But failure of the dam could put tailing water and solids into the river, the report warned.

The agencies suggested that a tailing pond be located in a small drainage that flows into the Hertzler Valley, well away from the Stillwater.

The site of the proposed mine is five miles southwest of Nye and sits on both private and national forest lands.

The commissioner of state lands will decide whether to approve a mining permit. He could approve it with modified mining or reclamation plans or attach stipulations to it.

The supervisor of Custer National Forest also must decide whether to approve or deny the mining plan as submitted or approve a revised plan.

LETTER #3

RECEIVED
APR 23 1985
STATE LANDS

April 20
1985

Dept. of State Lands
Capitol Station
Helena, Mont 59620

Re: Mining
in Absarokee
area @ the
Stillwater Complex

To Whom it May Concern:

I know our country is dependent on an adequate supply of minerals – in this instance platinum & palladium. It is also my belief that such mining companies must be in part responsible for the social & economical impacts it brings to these areas now and later.

My main concern is that the state department responsible for monitoring these things be given adequate finances to carry on their duties in the interest of our citizens.

Although, at present this mining will not have a direct effect on our area, at some future time, I am

Thank you for your comments. The final EIS (see Chapter 1) lists mitigating measures that the agencies will require of the company. These mitigating measures, including routine inspections and monitoring of the company's operation, would help assure compliance with state and federal environmental standards.

aware, this may occur. Therefore I urge your department to do all in your power to mitigate the many negative effects of the mining in the Libby [illegible] & Troy areas. Do your utmost to see that the mining companies share proportionately their part in being responsible citizens. The minerals in our forest belong to us all despite the fact the mining companies foot the bill to extract it. They reap the profits and in turn should do their work responsibly.

On these points, I strongly urge your support.

Sincerely

Mrs. Dolores Anstett
The Tall Timber
McLeod Mt
59052

P.S. My husband, Arthur W. Anstett concurs with these sentiments & opinions.

LETTER #4

RECEIVED
APR 30 1985
STATE LANDS

Dear Kit Walther,

I'm writing in reference to the proposed mine in the Stillwater area near the Beartooth-Absaroka wilderness area.

I am very much opposed to this project. I believe the resources recovered have such small value compared to the permanent damage to aesthetic values of one of Americas finest & most beautiful areas.

This is not to mention the damage to the local social system by radical changes in economy & infrastructure. For One generation, thirty years, this conglomerate wants to destroy a way of life generations old. Completely change

Thank you for your comment.

LETTER #4

it, rape & run, in just thirty years. This is absolutely ridiculous Boom & Bust & only thirty years NO! we can't allow this.

Thank you

Sincerely

James Henderson

LETTER #5

April 23, 1985

RECEIVED
APR 30 1985
STATE LANDS

Mr. Kit Walther
Dept. of State Lands
Capitol Station
Helena, Mt 59620

Dear Mr. Walther:

We were both born and raised in the Stillwater Valley and we have chosen to raise our family here, therefore, we feel we must reply to the article in Saturday's Billings Gazette regarding the proposed development in the Stillwater Complex.

This article makes it seem that the county will derive no benefits from the proposed development. No mention is made of the economic stimulation we would receive. Granted, the area would experience population growth and the schools, water and sewer systems, law enforcement, roads, etc. would need to be expanded and up-dated. However, it is our understanding that the mining companies have expressed a willingness to put money "up front" to help defray the cost of upgrading these services.

At the present time we watch vehicle after vehicle drive through Absarokee on the way to the compgrounds and fishing accesses. These weekenders buy their groceries, beer and gas in Billings. The only thing they leave behind is Stillwater County is their garbage. You can bet it isn't their money. We think it would be a welcome change to see mining company vehicles on our roads and be able to know they were contributing something to our economy.

Stillwater County has, at present, an agriculture-based economy and I'm sure you don't need us to tell you that agriculture is in real trouble financially. Without some input from some other source the majority of the small businesses in this county won't be able to survive much longer.

Unemployment in our county in the 20-30 age group is a real problem. Without the employment opportunities offered by the mining this county stands to lose one of our most valuable resources, our young people. They are finding it necessary to go elsewhere for jobs and they aren't coming back.

Please consider the human factor and not just the impact on the environment when you make your decision as to whether or not to allow the mining development.

Sincerely yours,

Mr & Mrs. Gary O. Borland

Mr and Mrs Gary O. Borland
Box 354
Absarokee, Mt 59001

Please refer to Chapter IV of the EIS for a full analysis of the project impact on the employment, income, and fiscal conditions in Stillwater County. The economic and fiscal benefits that would be derived from the project area are described in detail. The benefits of the project are taken into consideration by the agencies.

LETTER #6

926 5th Avenue
Laurel, MT 59044
April, 27, 1985

RECEIVED
MAY 02 1985
STATE LANDS

Mr. Kit Walther, Chief
Environmental Analysis Bureau
Montana Department of State Lands
Capital Station
Helena, Montana 59620

Dear Sir:

I've read the Environmental Impack Statement on the Stillwater Project.

I see the mining costing both Columbus and Absarokee a bundle for schools, sewers, water and roads. I see the county and state having to build roads and maintaining them. I see the people picking up the bill for all this in taxes. You tell us all those chemicals won't hutt the river or the water. The spill piles will be hid and won't look bad at all. In 30 years when the mining company moves out and all the workers leave it will all be put back as it was?

I know we can't stop the mining, but is this progress? All, so a few people can get Richer. Well, we can always look back and remember how it used to look.

Sincerely yours,

Harris C. Olson

Harris C. Olson

mo

Please refer to the Introduction and the Community Services section of Chapter IV for a description of the hard-rock mine impact mitigation act and the requirements that large-scale mineral developers must fulfill to mitigate increased government costs due to project development. Stillwater County and Stillwater Mining Company jointly authored and approved an impact mitigation plan for this project. The county planning office has a copy of the final plan that you may read. The company has agreed to provide $2.3 million in tax prepayments and financial aid to offset the increased cost of providing schools, water, sewer, roads, social services, medical care, law enforcement, and general government services. This financial aid will continue through the first four years of the project. In year five and thereafter, according to estimates included in the impact plan, the tax revenues paid by the project and miners who move into Stillwater County should cover the increased government costs after the project is fully operational.

After mining, the company would dismantle and remove all surface structures, and reclaim all disturbed surfaces including the tailings pond. The company's reclamation plan would restore previous land uses to the area, although there would be irreversible visual changes. These changes would not adversely affect the future utility of the land.

LETTER #7

DEPARTMENT OF THE AIR FORCE
AIR FORCE REGIONAL CIVIL ENGINEER CENTRAL REGION
1114 COMMERCE STREET
DALLAS, TEXAS 75242

7 MAY 1985

RECEIVED
MAY 10 1985
STATE LANDS

Mr. Kit Walther, Chief
Environmental Analysis Bureau
Montana Department of State Lands
Capitol Station
Helena, Montana 59620

Dear Mr. Walther:

Thank you for allowing us the opportunity to review the Draft Environmental Impact Statement for Stillwater Mining Company's proposed platinum/palladium mine near Nye, Montana.

We continue to express our support of the BLM in developing functional management plans for lands under its control. The Air Force concern for these management issues contains the need to retain use of existing and the establishment of future military flight training areas and routes which may traverse these areas.

Currently several Air Force air operations including instrument flight training routes traverse a portion of the study in question. Although flight training areas, routes, and airspace requirements of the military are subject to change and do change frequently, it is not anticipated that new routes will be established in the immediate future. However, if we do propose any change we will keep you informed.

Mission requirements, fuel costs and environmental constraints determine the decision to locate military training activities. Because of general aviation and population pressures, low level high speed flights are relegated to areas which are least accessible and sparsely inhabited. Therefore, we request that you give full consideration to how planning and management decisions made by your agency may adversely affect or restrict use of low altitude airspace by the military. The Air Force position on this matter is based on the high training and readiness values rendered by use of this low altitude airspace.

We are hopeful this information is useful in your planning. If additional information is needed, our staff point of contact is Mr. Raymond Bruntmyer, (214) 767-2527, or FTS 729-2527.

EDWARD LOPEZ, Chief
Planning and Intergovernmental Affairs Branch

Cy to: HQ USAF/LEEV

Thank you for your comments.

LETTER #8

STILLWATER VALLEY RANCH
NYE, MONTANA 59061 • (406) 328-8423

May 13, 1985

Commissioner Dennis Hemmer
Montana Department of State Lands
Capitol Station
Helena, Montana 59620

RECEIVED
MAY 14 1985
STATE LANDS

Dear Commissioner Hemmer:

This letter comments on the Draft Environmental Impact Statement pertaining to proposed mining operations by the Stillwater Mining Company at Nye, Montana.

INTRODUCTION:

We are John & Carolynn Mouat. We operate the Stillwater Valley Ranch which adjoins the settling pond land used by the American Chrome Company to dispose of their tailings during operation of the chrome mines used to produce a Government chrome stockpile from about 1955 to 1965. We operate a high-quality Ranch, Fly Fishing Center and Recreation Center. This ranch is a Corporation owned wholly by John Mouat. It has been operating continuously from 1966 to the present time. A copy of our brochure is attached.

A Background:

The American Chrome Company maintained the tailing pond adjoining our ranch during the production of the chrome stockpile. When the Government contract was terminated in about 1965, American Chrome Company simply walked away from the project. Buildings were abandoned, water pumps used to flood the tailing pond were turned off and the pond was allowed to dry up. During the next 3 years, Southwest winds of up to 100 MPH blew the dry tailings onto my ranch and onto the adjoining Forest Service. Millions of tons of this fine sand mixed with chrome dust created sand dunes of up to 50 feet in depth on our ranch and the Forest Service.

It is less than a quarter-mile from our house on the Stillwater River to the towering mountains to the South. When the wind was over 40 MPH, the sand blew so violently that one would not see the mountains. Nye Creek, which flows through the ranch and empties into the Stillwater River near the ranch house was (and is) filled to its full depth, 10 to 15 feet in places, with sand. Attached is a picture of Nye Creek taken on the creek May 1, 1985. The water flows in the creek near the mountains and disappears into the sand, where it

DUDE RANCH • PACK TRIPS • HORSEMANSHIP SCHOOL
"STILLWATER STAMPEDE" • FLY FISHING • RANCH RODEOS

A The tailings problem caused by the American Chrome Company predated the Montana Metal Mine Reclamation Act and regulations. These rules and regulations were published to prevent recurrence of such incidents. The SMC operation would not be a major source of additional dust. In the event that the mine closed and was not reclaimed, the Montana Department of State Lands would reclaim the area with the bond posted by SMC. If the bond would not cover the costs, the Department could sue SMC to recover the total cost of reclamation. Also please refer to Letter #35, response B.

LETTER #8

simply disappears. None is flowing into the river. Also enclosed is a picture showing the sand layers over the snow in Nye Creek in the winter.

The sand has infiltrated into everything. Windows are sand-blasted, the paint is stripped from vehicles left outside, sand gets into the working parts of chain saws left in the garage and ruins them. The worst part of all is the fact that the air we breath is so polluted that we have had to wear masks. Some of us still suffer from respiratory problems caused by the sand.

Anaconda Corporation subsequently acquired the chrome mining property, including the tailing pond, from the American Chrome Company. Two officials of that Company, Mr. Anderson, Vice-President and Mr. Frank Laird, Environmentalist, cooperated fully in trying to bring the problem under control. Several years were spent in dozing top soil over the sand, creating sprinkling systems, constructing ponds and planting ante-erosion grasses. The cost to Anaconda, as well as to myself was staggering.

At best, the air pollution caused by blowing sand was arrested.....not stopped. There are still millions of tons of tailings on our ranch, on the adjoining Forest Service and on the tailing pond. Nye Creek still fills with sand, our windows still get blasted and machinery and vehicles still get ruined. Worst of all, the ponds still fill with sand and sometimes the dikes break, inundating us with a wall of water and sand. There is no Anaconda Corporation anymore to help us....we must face these problems and pay for their solution ourselves.

Proposed Venture:

The Draft Enviromental Impact Statement outlines what would probably happen if the Stillwater Mining Company commences platinum and palladium mining at Nye, Montana. Without attempting to comment on each element of the Environmental Impact, we will simply summarize...the impact upon our ranch operation and the factor that create that impact.

STATED IN A NUTSHELL, WE WILL BE FORCED OUT OF BUSINESS IF THE MINING VENTURE COMMENCES. The reasons are as follows:

B A. NOISE: The Environmental Impact statement says, "Noise levels near the milling complex would increase considerably." This is an understatement! During the test drilling operations, only t he air turbine was operating. Yet, the noise from this turbine was so excessive at our ranch, a half mile away, that most guests complained about this factor. Some even stated that they would not have come if they had known the peace and tranquility would be broken. by this noise. Multiply the noise level by perhaps a factor of 50 or 100 and the result at our ranch would be deafening. No guest would either stay or return under these circumstances. Return guests are necessary for us to stay operational.

C B. Commercial Vehicular Traffic: There would be many commerical vehicles operating at the mill area, only ¼ to ½ miles away. The noise, congestion, dust levels and general commerical atmosphere would be a lethal deterrent to retaining guests at the ranch.

D C. Trail Rides: One of our most spectacular trail rides is to Horseman Flats. This is an all-day ride which traverses up the side of a mountain with magnificent overlooks en route and ends at a beautiful spring and aspen grove. The draft proposal would close this trail to us (and the general public) because of mine traffic in the area. Also, we conduct all-day rides to Sioux

B The analysis presented in chapter IV was based on the equipment information submitted by SMC. If the noise levels were greater than anticipated, the Department of State Lands would require SMC to implement measures to reduce nuisance noise levels.

C The traffic reduction mitigation (see Chapter I) would reduce projected traffic increase on FAS 419 and associated noise levels. If found to cause a nuisance, SMC could be required to implement measures to reduce noise congestion and dust.

D Measures are available that would reduce the project's effects on trail rides by the Stillwater Valley Ranch. First, the Forest Service will allow reestablishment of the old trail along the ridge between Stratton and Bass ranches to provide an alternative route to Horseman Flats.

LETTER #8

Charley Lake, travelling part of the way over the road between the ranch and the Woodbine trailhead. Increased commercial traffic would probably create unacceptable dangers to continuance of this ride. In essence, our most beautiful and most spectacular trail rides would be cut off.

E D. Wildlife and Fishing: There would be a sharp decline in levels of wildlife and river fishing. The spectacular Big Horn Sheep herd would virtually, if not completely, disappear. Most of our guests come to see this wildlife and enjoy good fishing.

F E. Tailing Pond Location: The Mining Company proposes to locate the tailing pond virtually across the road from our ranch. (The agencies prefer the hertzler Ranch). This would be a cruel disfigurement of the landscape and a hideous view for our guests to behold. They simply would not accept it.

G SUMMARY: For reasons stated above, we would be forced out of business. We provide employment, either thru direct hire or contract, to several people (approximately 20) in the community. Our guests also add to the economy of the area. If we are forced out of business, several local people would lose their livelihood and the community would lose the economic advantages of our business. We deal in bringing guests from out of state to view and share Montana's glorious natural beauty. The mining operation, in contrast, would result in a savage and cruel disfigurement of this natural beauty.

AS A RESULT, STILLWATER VALLEY RANCH WILL RESIST, WITH WHATEVER MEANS THAT ARE AT OUR DISPOSAL, ANY ATTEMPT TO DESTROY THE NATURAL BEAUTY AND WILDLIFE AROUND US, WITH THE CONSEQUENCE THAT OUR BUSINESS AND OUR WAY OF LIFE WILL BE DESTROYED.

H POST-SUMMARY: Nowhere in the Draft Enviromental Impact Statement does it deal with what happened to the American Chrome Company operation when the mining ended.....simply dissolve the business entity....walk away from it.....and leave the disaster area for local residents to contend with. What is to prevent Stillwater Mining from doing the same thing? For years we have tried to get State and County officials to visit us to view the American Chrome disaster area. None have come! Apparently none are interested!!

We invite the addressees of this letter to see this disaster for theirselves (although Anaconda Corporation and ourselves have cleaned up most of the mess, much still remains. Come and see Nye Creek filled with sand and the bed of the Stillwater River covered with sand and precluding fish from spawning.

If you will just come and see this terrible, hideous mess for yourselves, perhaps your awareness of the full nature of the potential environmental problem will be broadened and sharpened.

Respectfully,

John L. Mouat Carolynn L. Mouat

John & Carolynn Mouat
Stillwater Valley Ranch
Box 385, Nye, Mt. 59061
(Phone:1-406-328-6222)

Copies: David Filius, Supervisor, Custer National Forest, Billings, Montana
Philip Jaquith, Beartooth Ranger District, Red Lodge, Montana
Kit Walther, Department of State Lands, Capitol Station, Helena, Mt.
Stillwater Mining Company, Nye, Montana

2 photos inclosed

Rides to Sioux Charley Lake could be arranged to avoid conflict with shift changes. In addition, the traffic reduction measure would mitigate potential transportation conflicts.

E The analysis in the EIS does not support your conclusion that there would be a sharp decline in bighorn sheep or fish populations. Please refer to Chapter IV, Wildlife.

F As stated in the draft EIS, "the mill and mine would significantly affect the visual resources at the minesite." Although the impact could be reduced, residents and travelers would definitely see a change in the landscape at the minesite.

G Your comment is noted.

H See response A. The EIS analyzes the impacts of SMC's proposed project. Effects of past mining are evaluated as part of the baseline conditions. Detailed discussion can be found in appropriate sections of chapter III. Present environmental regulation will ensure compliance with environmental standards and that after mining, all disturbances are successfully reclaimed.

U.S. Department of Housing and Urban Development
Denver Regional Office, Region VIII
Executive Tower
1405 Curtis Street
Denver, Colorado 80202-2349

LETTER #9

RECEIVED
MAY 15 1985
STATE LANDS

May 10, 1985

Mr. Kit Walther
Chief, Environmental Analysis Bureau
Montana Department of State Lands
Capitol Station
Helena, Montana 59620

Dear Mr. Walther:

This is in reponse to your request for comments on the Draft Environmental Impact Statement (DEIS) for Stillwater Mining Company's proposed Platinum/Palladium Mine near Nye, Montana.

Your DEIS has been reviewed with consideration for the areas of responsibility assigned to the U.S. Department of Housing and Urban Development. This review considered the proposal's compatibility with local and regional comprehensive planning and impact on urbanized areas. Within these parameters, we find this document adequate for our purposes.

If you have any questions regarding these comments, please contact Mr. Howard S. Kutzer, Regional Environmental Officer, at (303) 844-3102.

Sincerely,

Robert J. Matuschek
Director
Office of Community Planning
and Development

Thank you for your comment.

LETTER #10

DEPARTMENT OF HIGHWAYS

TED SCHWINDEN GOVERNOR
2701 PROSPECT
STATE OF MONTANA
HELENA, MONTANA 59620

May 17, 1985

RE: Draft EIS for Stillwater
Mining Co.'s Proposed
Platinum/Palladium Mine.

RECEIVED
MAY 20 1985
STATE LANDS

Mr. Kit Walther, Chief
Environmental Analysis Bureau
Reclamation Division
Montana Department of State Lands
1625 Eleventh Avenue
Helena, MT 59620

Dear Kit:

Thank you for the opportunity to review the above captioned EIS.

The majority of the transportation impacts will be focused on FAS 419, which is currently under County jurisdiction. However, since this route is a part of the Federal Aid secondary system in Montana, our comments will be directed towards protection of this investment.

Of the six alternatives, and proposal desired by the applicant, Alternative number 5 would be the least desirable.

A As you are aware, County budgets are already strained and Secondary Highway funds are very limited. Any additional burden placed on Stillwater County to improve FAS 419, without adequate fiscal compensation from the applicant, should be avoided if at all possible.

B Two items that were proposed in the draft EIS that would significantly reduce potential safety hazards and also reduce possible increased maintenance costs should be actively pursued. (1) Bussing the workers to the minesite, and (2) Reducing the truck traffic on FAS 419 to one concentrate truck per day.

C The applicant proposes to relocate a portion of FAS 419 and also to construct a tailing pond within close proximity of FAS 419. Attached is a rough draft of a memorandum of understanding that we developed that would be signed by the applicant, the county, and MDOH. Contents of the M.O.U. address the majority of our concerns about the proposed project.

Please note that the M.O.U. was developed after consultation with the county and in no way is a mandatory document or additional permitting procedure. The intent of the M.O.U. is to outline the duties and obligations of all parties concerned and it will be up to the discretion of the county if this document is to be consummated.

A The applicant has agreed in the hard-rock impact plan to provide a percentage of the cost to improve FAS 419 if federal funding becomes available to the county. The company will provide up to 20 percent of the actual cost (limited to $1.46 million) of reconstructing FAS 419 through 1990 and 10 percent of the actual cost (limited to $730,000) through 1995. If the county does not receive funds to improve FAS 419 prior to 1995, the company will not pay any of the reconstruction costs.

B The final impact statement recommends that the mine permit be conditioned so that the company achieves a reduction in project-related traffic increases (see Chapter 1, Preferred Alternative). Please note that, except for alternative 5 (refer to DEIS), all project alternatives would require only one ore concentrate truck to make one round trip per day between the mill site and Columbus.

C Comment noted, thank you.

LETTER #10

Kit Walther
May 17, 1985
Page 2

If you require additional information, please contact this office.

Sincerely,

Keenan Bingham
for L. S. "Buck" Harris, Chief
Planning and Statistics Bureau

LSH:DWC:ts:lh

Attachment

cc: Duane Meiers
Robert Champion
Bill Strizich
Don Gruel
Homer Wheeler
Will Hutchison
Bill Dunbar, FHWA

LETTER #11

Absarokee Mont -
May 16th 1985 -

RECEIVED
MAY 20 1985
STATE LANDS

Kit Walther Chief
of Reclamation Division
Dear Sir;-

The Public meeting at the High School Gymnasium in Absarokee met - was very stimulating Educat-ional & down to the point, of what People wanted to know, in regard to the Mountain project,

I do not see that it is necessary to haul over the old tailings & etc, as they were no doubt - paid for - and the American Chrome Co. - failing to clean up the area - this is repugnant to my way of thinking -

I think that we have come to the Cross Roads & due for a change in Progress of which is in the offing -

I do not think that the Selfishness of one Man or

Thank you for your comments.

LETTER #11

Woman should stand in the way, - no matter as to whom they are from whence they came -

If the Mine development isn't continued at this time and we should need Strategic material it might & could be very devastating, as some of these minerals are not on our finger tips - if work isn't accomplished in this Generation Stop & Think?? it may be far to late - I see no reason why this Project should not be followed up.

I own my own Property here in the town of Absarokee - am in the 80's & there for am not looking for a - job -

Sincerely,
Eva M. Landon
Box 365
Absarokee Mt
59001

May. 18, 1985
Belgrade, Mont.
59714

Dear Sir/Madam

Having an interest in and around Absarokee, I am protesting a mining of platinum. I'd rather things stayed the way they are.

I was around, when Mouat Mine was operating, and don't think we need that again.

I'll admit I am a lover of Nature, and would like to see the Absaroka Beartooth Wilderness not disturbed.

I am sure there's enough platinum and palladium someplace else.

Let's not tear up something that can not be replaced.

Ed Coughlin

Very much against it!

RECEIVED
MAY 20 1985
STATE LANDS

Thank you for your comment.

LETTER #13

RECEIVED
MAY 2 1 1985
STATE LANDS

May 17, 1985

Kit Walther
Montana Dept of State Lands
Capitol Station
Helena, Montana 59620

Dear Sir:

Enclosed please find a statement which I have written regarding the upcoming mine project near Absarokee.

I had hoped to be there to present my statement in person at the public hearing, but through necessity, I was working in Forsyth at the time.

Thank you for your considerations.

Best regards.

Very truly yours,

Richard Porter

Richard Porter

COMMENTS ON THE MINE MEETING

OF

MAY 15, 1985

ABSAROKEE, MONTANA

BY

RICHARD M. PORTER
1770 BROADVIEW DR.
BILLINGS, MONTANA
59105

LETTER #13

Dear Sirs

I would like to thank the panel and their departments for the opportunity to give my comments regarding the mining operations proposed for the Stillwater area.

Having been a land owner and tax payer in the county for nine years or more I am seriously concerned about the impact that the proposed operatins will have on Stillwater County. In weighing the pros and cons I feel the mine could operate and the county will adapt to the impact that such an operation will bring. The following views are given from my experiences in the construction trades and from the abstract of the Overview of the Forest Plan sent out to individuals requesting that information.

Of the Sixteen Alternatives it seems that Alternative number six is the recomended course of action for the public lands that surrond the mining areas. So far I concur with the experts partly out of trust but mostly from following their logical and practical line of reasoning.

Alternative Six provides for mineral extraction impact of the Stillwater area of the federal lands the USFS has jurisdiction over. In talking to other tax payers in the area I have yet to run in to a person that is against the mine. Many arguments have been brought forward through the media but none of which are new to the Draft Environmental Impact Statement subjects.

The problem of the increased Recreation-Visitor-Days(RVD's) because of the population increase in the area is taken into account by maintaining the existing camping facilities, and by modifying the wilderness and roadless areas. "The opportunity for dispersed recreation will increase, due in part to the greater road-building program for commodity development, particularly for oil and gas production." Since only 17 miles of roads are proposed for the Absorka-Beartooth area and only 9 of those miles will be permanent, the AB area will be the least disturbed development in the Custer Forest that reaches almost to the Dakota-Minnesota border. This 9 mile

Thank you for your comments. The agencies considered the information available in the Custer National Forest Plan. Information contained in the Custer National Forest DEIS and summarized in the Overview Plan is not directly applicable to the wildlife sections of the Stillwater EIS. The Forest Service predictions to which you refer summarize impacts throughout the Custer National Forest and Grassland (covering 2,445,800 acres in Montana, North Dakota and South Dakota). In contrast, the Stillwater project DEIS focuses on the upper Stillwater Valley. Besides the figures that you cite, the Forest Service presents a wide array of management directives and alternative plans. Predictions on impacts to wildlife would therefore vary, depending on the directives and alternative chosen by the Forest Service. Your other comments are noted.

LETTER #13

projection represents only 1.2% of the roads the Custer Forest forsees for the next ten years in the area. The other 8 miles are mostly the temporary roads that the 1985 gas and oil exploration projects in the district will use and return to original grade and restore as good as possible when they are finished. 52,040 acres are also scheduled to be set aside as roadless areas and 9,800 acres of the Lost Water Canyon of the Beartooth district are due to be added to the Wilderness classification or a combination of 5,812 acres of the Lost Water Canyon and 5,150 acres of the Burnt Mountain, Red Lodge/Hell Roaring Area are to be added to the wilderness classification.

The arguement that the increased population will put more pressure on the game animals may merit some special attention by the state Fish and Game people but according to the studies by the USFS the upland game bird population my increase due to better habit management, the deer population should remain stable and the elk habitat will steadily decrease in the 70 year period but not due to mining and exploration surprisingly enough but to the steadily increasing Animal-Unit-Months allowed for the grazing of livestock.
Of the roughly 2.5 million acres administered by the Custer Forest 1.6 million or well over half is considered good for livestock grazing. "At present , Approximately 875,000 AUM'S ...of livestock grazing occur on the forest each year."
For the next three decades the AUM's will increase to 894,000 then climb slowly to 913,000 AUM,s. This led me to believe that the management of the habitat for the game animals will be directed toward close interaction between the Governing agencies and the livestock produces rather than the increased hunter population. Recently, in Bighorn County the hunting was controlled jointly by good regulation by the state and advertised stipulations of the private land owners. We working in the area were glad to donate a fee to help the private owner with certain expenses that our hunting my bring and the hunting problems in that area were minimal.

LETTER #13

In conclusion the best way to decide a yes or no to this proposal is to balance the costs versus the benefits. For instance, non-revenue producing activities such as "..water shed activities, reasearch at various locations, most recreational facilities and areas, control of fire, insects, diseases and noxious weeds, various education and information activities, wildlife management programs, and efforts to protect the habitat of threatened and endangered species...'these' expenditures must be viewed as general operating costs..." On the plus side the Forest ..."produces significant revenues from grazing fees, various hard-rock leasing fees, fees from oil and gas leasing for exploration and development, royalties on oil and gas production, pipeline and transmission line rights-of-way, charges for certain recreation sites, fees for a variety of special use permits, and others." By law, "25% of those revenues from all Forest programs are paid to the respective State Treasurers, who distribute them to the counties to be used largely for road and school purposes." The proposed first decade costs will be around 7.6 million and the expected revenues will be close to 49.3 million which nets 41.7 million or the 25% to the State will be 10.4 million. Thats directly into the State kitty but the indirect benefits are much more. For instance, those nine miles of permenant roads in the Beartooth area may cost around $17,600 per mile. of that about $13,600 will stay in the imediate area from local taxes, wages, fuel costs and equipment and living expenses.

As with all development in rural areas someone will be in a losing position but I feel as long as the parties keep talking a compromise can be reached and the use of the lands in question can benefit all. For those that doubt that these problems cant be resolved call the Sheridan, Wyo. Chamber and ask what they think of the mining families living there that work in Decker, Mont., or drive to Colstrip Montana and look at their school, businesses, residences and farm land. If they saw that town ten years ago they'd never know it was the same one, Or drive through Hysham and look at that new school, or drive by the Decker mines and see all that grazing land that was once mining trenches.

If all the sewers water,and other social impacts are going TO BE remedied the development should be welcomed.

Richard M Porter

LETTER #14

RECEIVED
MAY 2 2 1985
STATE LANDS

Mr. Kit Walther
Department of State Lands
Capitol Station
Helena, MT. 59620

May 17, 1985

Dear Kit,

My name is Sam Corson and I work for Stillwater PGM Resources in Absarokee, MT. I was at the hearing Wednesday night which addressed the Draft E.I.S. for Stillwater Mining Company.

I thought the hearing went rather well except that not much was said about the proposed tailing site versus the alternative #4 tailings site; which seems to be the major variation between the different proposals. The following comments deal with the two sites.

(1) PROPOSAL

- Although the height of the dam would be higher; the plan is for a 5 stage construction plan. Any major problems with potential failure of the structure would probably be noticed early in the development stage when the dam wall is much lower (50-80') and steps could be taken to avoid similar problems for the later stages of dam construction (80-160').

- The aesthetics would definitely be affected by the size of the dam wall; but the aesthetic affects would be considerable for both the minesite and the Hertzler locations.

- The proximity of the pond to the Stillwater River is the only major strike against the minesite proposal.

(2) ALTERNATIVE 4

- The dam height at the Hertzler Ranch proposal would be lower but the ground surface area covered by the pond would be much larger than the area covered by the minesite tailings pond proposal.

- The slurry line would most likely be above ground and is proposed to run in the ditch along the highway from the minesite to the ranch. This distance is around 8 miles in which slurry line would be laid. The increased costs involved would affect this proposal along with the aesthetic affects caused by a supended slurry line running along the only major highway with access to the valley. Other problems dealing with the slurry line such as the possibility of vehicle accidents or sabotage causing a break in the line and the possible

Thank you for your comments. Your comparison of SMC's proposal and alternative 4 agrees with that described in the draft EIS, except that the slurry pipeline to the Hertzler Valley would have less visual impact because the pipeline would be buried. This would also protect the pipeline from sabotage and vehicle accidents. The cost comparison for the alternatives prepared by SMC assumed that the pipeline would be buried.

LETTER #14

contamination of the Stillwater River could occur.

- The proximity of the slurry line to the river and the visual affects caused by the line would be the major strikes against the Hertzler Ranch proposal.

The decision made concerning tailings location will be difficult; both sites considered have positive and negative qualities. After attending the meeting I thought a letter was in order to let you know my feelings. I will be interested to see what alternative the DSL will choose in the final EIS.

Thank you for your time.

Sincerely,

Sam Corson

LETTER #15

RECEIVED
MAY 2 4 1985
STATE LANDS

Dear Sir;

In regards to the draft statement proposed on the platinum - palladium mine in Stillwater county. I am an owner of a hardware store in Absarokee so of course the mine would help me, however, I would like to look at how much it would help the county. As I am sure you are aware of the Economical situation of agriculture. We are in need of some other type of industry. As a graduate of Absarokee in 1975 I have had a hard time being able to have an occupation in which I could live in this area. However if the mine would be able to go in it would open a greater variety of jobs for the Absarokee and surrounding people. Where as now there is no future for a younger person in this area, since agriculture is so hard pressed. I hope this letter has shown my opinion to you and that if I could be of any help to please contact me.

Sincerely
Ralph Young

RALPH Young
RR1 Box 5B
AbsAroKee Mt
PH. 328-4370 or 4965

Thank you for your comment.

United States
Environmental Protection
Agency

Region 8, Montana Office
Federal Building
301 S. Park, Drawer 10096
Helena, Montana 59626

EPA

LETTER #16

MAY 3 1 1985

Ref: 8MO

RECEIVED
JUN 0 3 1985
STATE LANDS

Mr. Kit Walther, Chief
Environmental Analyses Bureau
Montana Department of State Lands
Capitol Station
Helena, Montana 59620

Dear Mr. Walther:

The United States Environmental Protection Agency (EPA) has completed its review of your Draft Environmental Impact Statement (DEIS) regarding the Stillwater Mining Company's proposed Stillwater Project. The Agency appreciates the opportunity to review this DEIS.

A As part of EPA's review, the Agency reexamined the DEIS prepared by your Bureau for the Anaconda Minerals Company's proposed Stillwater Project. In the 1984 document, your preferred alternative states that the tailings pond would be located in the Hertzler Valley. The tailings would be transported with a slurry pipeline. In the 1982 DEIS, two of three Hertzler Valley locations were deemed "unsatisfactory". The slurry pipeline was also deemed to be unsatisfactory to transport tailings from the mine site. Is the proposed 1984 Hertzler Valley location the recommended 1982 Hertzler Valley location? What new information was evaluated to cause your Agency to recommend the slurry line? These questions need to be addressed in the 1984 DEIS.

B The DEIS indicates that all State and Federal water quality requirements would be achieved. Nevertheless, the Agency is concerned that monitoring requirements are not more clearly defined. These requirements should be described in the final EIS, (e.g., frequency parameters, definition of "upset" situations).

C The DEIS indicates "that the Company could prepare a pollution - control contingency plan to plan a prepared response to unanticipated leaks or spills from the tailings impoundment". EPA recommends that the final EIS state that this will be a requirement of the Company, and that the content of this plan be described in at least a general fashion. A similar plan should be prepared for other activities which could have potential adverse environmental impacts (e.g., slurry line).

A The Hertzler Valley tailings disposal site described in the 1985 DEIS (alternative 4) is the same site (site B) proposed earlier by the Anaconda Minerals Company (AMC) and analyzed in the 1982 draft EIS. The reasons for dismissing the other two Hertzler Valley sites (C and D) are given in Appendix 1. The 1982 draft EIS did regard the option of slurrying tailings from the minesite to Hertzler Valley as unreasonable. However, several factors caused us to reconsider our evaluation of the slurry pipeline. The potential for vandalism and auto accidents causing rupture of the pipeline would be eliminated by burying the pipeline in the road right-of-way. An emergency tailings pond at the mine/mill site would help control the volume of tailings that could spill should a rupture occur. In addition, safety technologies could be designed along the length of the tailings line to allow for monitoring and controlling of leaks. Special precautions, such as emergency spill ponds and a double lining at river crossings, would also provide protection against direct spills into surface waters. Also, county-owned right-of-way would make acquisition less of a problem.

Furthermore, the agencies considered the slurry pipeline along with other selection criteria in the 1985 DEIS (see Chapter I--selection criteria). When these other criteria were considered, the agencies concluded that alternative 4, with a slurry pipeline had noticeable environmental advantages.

B Neither NEPA nor MEPA regulations specify that monitoring plans need to be described in detail in an environmental impact statement. Detail of this nature is not germane to the evaluation of the project's environmental impacts. An approved surface and ground water quality monitoring plan, however, will be required before the company can begin mining. The plan will be developed in cooperation with the state Water Quality Bureau, the Forest Service, and the company. The plan will address specific monitoring requirements such as parameters, sample frequency, sample locations, and sampling methodologies.

C The preferred alternative requires the company to prepare a pollution-control contingency plan for agency approval. The plan will address pollution-control procedures in response to potential failure of the tailings dam.

LETTER #16

D The 1984 DEIS states that the Hertzler Valley tailings pond will be unlined. Most of the seepage would be collected using an underdrain and sump pump system. Was modeling completed to support your position that the quality of the ground water in the valley will be adequately protected with this system?

E The 1984 DEIS indicates that the post-mining soil quality would be fair, at best. These impacts would apparently be most severe under your Agency's preferred alternative. Your document does not propose mitigation measures to reduce soil deterioration, or indicate that this approach is impractical. The Company will apparently be held accountable for revegetation. The final EIS needs to describe the standards of performance that your Agency will require from the Company to address the site restoration issues. Your document suggests that material will not reach the Stillwater River in the event that the tailings pond fails. What is the basis for your conclusion? If revegetation takes many years, is there a non-point (soil) pollution problem?

F EPA's overall rating for the DEIS is EC-2 (environmental concerns - insufficient information). The Agency is concerned with potential adverse environmental impacts based on questions raised by your DEIS. There was not sufficient information to enable the Agency to fully concur with conclusions presented in your DEIS. If you have questions or concerns, please call me at 449-5432.

Sincerely yours,

John F. Wardell

John F. Wardell, Director
Montana Office

D Based on a mass-balance approach to water quality changes, an unlined pond with an underdrain system was determined to be adequate. The tributary valley in which the pond would be located is underlain by tight Colorado shales. In addition, the moderately transmissive glacial material overlying the shale is relatively thin, limiting pond seepage into the Hertzler Valley. The amount of flow lost to the Hertzler Valley was determined to be only a few gallons per minute (based on pond water height relative to valley ground water levels [gradient], width and depth of flow path, the hydraulic conductivity of the glacial material, and an assumed high recovery rate for the underdrain and well battery system). Using this seepage rate and ground and surface water flows and quality, estimates of concentrations of milling reagents were calculated for the Hertzler Valley ground water and the Stillwater River. Calculated concentrations would be very low and would not affect beneficial water uses (see Appendix C and D).

E We assume that the soil deterioration referred to in your letter is that which is discussed in the draft EIS for alternative 4 on pages IV-16 and IV-17. On pages IV-17 through IV-20 of the draft, mitigations are proposed that would increase water- and nutrient-holding capacities and stimulate some biological activity in the soils. No feasible method of artificially reestablishing mycorrhizae currently exists. Although the concept is unproven, a suggested mitigation is given on page IV-18 that could sustain mycorrhizae during soil storage.

In the FEIS, alternative 4 has been deleted (see Preface). The agencies' preferred alternative is the revised company proposal. To reduce soil impacts, the company would be required to salvage soil in two lifts (see Chapter I).

The agencies will require that the reclaimed areas be of comparable utility and stability of surrounding, undisturbed areas.

Failure of the Hertzler Valley tailings dam would not likely result in tailings reaching the Stillwater River for the following reasons: the dam would be located 1-1/2 miles from, the river; there is very little contributing watershed above the pond; the descending drainage is broad with flat hayfields.

F The agencies feel there is adequate information to evaluate the alternatives and the agencies' analysis. The document should be rated EC-1 (environmental concerns-sufficient information).

LETTER #17

5-30-85

I oppose the proposed platinum & palladium mine near Nye, Montana & the Stillwater river.

The tailings from previous mining are already an eyesore there & any possibility of polluting the beautiful Stillwater should be considered very strongly.

Please.

Vicki Gill King
2021 Southfork Rd.
Cody, WY 82414

(I own property in the Crazy Mountains of Montana.)

RECEIVED
JUN 03 1985
STATE LANDS

Thank you for your comment.

RECEIVED
JUN 0 5 1985
STATE LANDS

LETTER #18

Mr Kit Walther

Please send copy of Draft EIS for SMC
Stillwater Project, Stillwater County
Platinum-palladium mine

Hilmer Weyler
Star Rt I. Box 6B
Columbus, Mt 59019
Custom Farming

Two copies if possible?

Dear Kit,
I went to the 15 May meetings and have studied both reports some. It seems, at this pt, it would be better to concentrate the scars at the site since the chemicals don't seem to be ~~that~~ toxic ?

HW

Thank you for your comment. Please note that in the final EIS the agencies have chosen the company's proposal as the preferred alternative. This alternative locates all mine facilities at the minesite.

LETTER #19

EASTERN
MONTANA COLLEGE
1500 North 30th Street, Billings, MT 59101-0298 Department of Music 406/657-2350

May 31,1985

RECEIVED
JUN 0 6 1985
STATE LANDS

Kit Walther, Chief
Environmental Analysis Bureau
Montana Dept. of State Lands
Capitol Station
Helena, MT 59620

Dear Mr. Walther:

A As a Stillwater Co. homeowner and part-year resident, I would like to voice a strong protest against any of the proposals and alternatives that are being considered for the Stillwater Mining Co. Project. I have primary objections to the tailing pond being placed in any of the proposed locations. I use FAS 419 and 420 every week from Spring through Fall, and know many people who use both routes recreationally, and can say that a tailing pond and mining operations will significantly alter the aesthetics and use of the Stillwater Valley trails and waterways. Having lived in Leadville, Colorado and experienced the Climax Molybdemum Mine tailing pond, I can only hope that I won't have to relive one of the grossest travesties to outdoor beauty that I have witnessed.

B I am also gravely concerned about the adverse effects of increased vehicular traffic in the area. The chrome ore transfer from the upper Stillwater valley to Columbus during 1980-81 posed a serious threat to safety and road quality, and proved in the eyes of many that existing roadways were not sufficient to support such an operation.

C Finally I am very concerned about the threat to wildlife, due to road-kill and nesting disturbances, and to fisheries in the event of a pipeline leak (under Alternative 4). The Environmental Impact Statement spells out high probability risk for bighorn sheep, deer, elk, falcons and eagles. Furthermore, I am not satisfied with the pipeline spill precautions, especially with regard to Johns-Manville's poor record in asbestos safety.

D In conclusion, the EIS points to negative effects of the Stillwater Mining Co. Project proposal in every criteria except economics. Although many of the negative points are stated as being "minor" to "insignificant", the sum of these becomes a sizable chunk of the ecological pie, and therefore seems like sound rationale for rejecting the entire proposal. And, speaking

A Comment noted, thank you.

B The chrome ore transfer did pose a hazard. However, during the operation, none of the trucks was involved in an accident with another vehicle or with other persons. A full-time employee was hired to oversee safety aspects of the chromium transfer. A meeting was held with the school bus driver to coordinate schedules and promote safety. It should be noted that ore transport by SMC is a much smaller scale, although it would be longer-term than the chromium operation. Only one truck per day would haul ore to Columbus.

In the final hard-rock impact mitigation plan (p. iii) accepted by the county, SMC agreed to pay Stillwater County (in the form of the prepayments) 20 percent of the actual amount for reconstruction of FAS 419. These payments are limited to $1.46 million if reconstruction begins before 1990. In addition, SMC would pay 10 percent of the actual amount for reconstruction of FAS 419 limited to $730,000 through 1995. No tax prepayment for impacts to roads are agreed to after 1995. These tax prepayments are based on the percentage of total traffic that will be generated by SMC.

C The agencies feel that the slurry pipeline would pose only a minimal risk to the environment over the life of the operation. Engineering technologies and materials are available to design and construct a safe pipeline between the mine/mill complex and Hertzler Valley.

Regarding your comment on potential wildlife impacts, the statement does not forecast a high probability risk for the species you mention.

D Comment noted.

E of economics, I also fail to see how the 223 newly-created jobs will be"permanent" (ESI, p.IV-47) when the projected duration of the mining operation is 30 years. Upon the closing of the mine, unemployment and the abandonment of housing and other social service physical plants will very likely turn the area into a microcosm of "what happened to Butte!" I therefore vote NO to all proposals and alternatives.

Most sincerely,
Mark Rider
Mark S. Rider
Resident, Billings and Beehive, Montana

E Permanent jobs, as used in the EIS, means the number of positions that will be hired by the company when the mine and mill are at full production. The term permanent refers to operations jobs as opposed to temporary construction jobs. As you are probably aware, employment at any business or institution is a dynamic process based on markets and demand for goods and services. The EIS is not meant to imply that SMC will employ persons forever in Stillwater County. The effects of a temporary or permanent closure of the mine are discussed in the EIS. Furthermore, Stillwater County should not be as severely impacted as Silver Bow County in the event of a mine shutdown. The Stillwater County economy is more diverse and would not be as single-industry dependent and unemployed SMC workers would have a larger job market available due to the proximity of Billings.

LETTER #20

John & Donna Halvick
Rt 2 Box 370
Nye, MT 59061
6-10-1985

Attn: Mr. Kit Walther
Chief, Environmental Analysis Bureau
MT Dept of State Lands
Capitol Station
Helena MT 59620

RECEIVED
JUN 11 1985
STATE LANDS

Dear Mr. Walther:

My wife & I would like to add our comments concerning your (EIS) for (SMC's) proposed platinum/palladium mine near Nye, MT in Stillwater County.

We have been caretakers for the Mouat Estate since Nov of 1957 and have lived in the Old Mouat house since Nov of 1958 until April of 1975, at which time we moved into a house we built approx 3/4 of a mile to the North of the Mouat house.

We are now speaking for ourselves & not for any of the Mouats.

We attended your meeting May 15, 1985 at the Absarokee High School Gym, & feel it was a good meeting & very well conducted.

We would like to say for the record, that while we appreciate John Mouat's concerns about the mine, we also know that he reaped benefits from the chrome mine — he built on property that Denny White's had already received a settlement on, and we feel it is hard to get grass started

LETTER #20

I worked for three years as a dozer operator for John Thompson Inc., while they were building roads, drill sites & doing reclamation for Anaconda, and feel the Forest Service did a good job of monitoring our work. In that light we feel that between the State & Forest Service the operation & reclamation will be properly controlled.

A We do have two main concerns that we would like to comment on. #1 is on Hydrology III-17 (paragraph #5) of your EIS draft. Since the mining not only reduced our spring flow - which we had used for 22 years with no problem - but stopped it completely, we are concerned about water. We have drilled a well - 125' deep at our new home, and would like to have protection against pollution and depletion. Suggest that monitoring & control within a 2 mile area of the mine would be sufficient.

B Our second concern is the location of the tailings pond. We feel the pond should be located located at the Hertzler ranch. In the event of a dike failure, or seepage, there would be more time and room to keep the tailings & water from polluting the Stillwater river.

Thank You!

Sincerely,
John Hjelvik
Donna Hjelvik

A Should mining adversely affect the quality or quantity of any wells or springs used for domestic purposes, SMC would be required to provide an alternate source of water. The agencies' preferred alternative (see Chapter 1) requires SMC to develop a spring flow monitoring program to collect hydrologic data and determine mining effects on nearby springs.

B Comment noted, thank you. The EIS, for the same reasons, acknowledges your concern of locating the tailings pond at the minesite near the Stillwater River. Potential for failure, however, is low.

JUN 13 1985
STATE LANDS

LETTER #21

United States Department of Agriculture
Soil Conservation Service

Federal Building, Room 443
10 East Babcock Street
Bozeman, MT 59715

June 10, 1985

Mr. Kit Walther
Department of State Lands
Capitol Station
Helena, Montana 59620

RE: Stillwater Project Draft EIS

Dear Mr. Walther:

We have reviewed the above draft EIS and offer the following comments:

A 1. Pages III-23 to III-34 (Vegetation)--On many of the vegetation types Spike Fescue (Hesperochloa kingii) and Bluebunch Wheatgrass (Agrophyron spicatum) are commonly found and are very important grasses. These grasses are often used as key grazing species when managing livestock in this part of Stillwater County and should be mentioned in the vegetation type descriptions.

B 2. Page III-74 (Land Use)--The property originally purchased by the Anaconda Minerals Company (approximately 340 acres) about three years ago near the Town of Absarokee has not been mentioned. Over 50 percent of this land is considered prime farmland and the possibility of this land being converted to residential use should be addressed in the EIS.

C 3. Page III-75 (Land Use-Current and Previous Trends)--An inventory of all subdivided land in Stillwater County, recently completed by the Columbus SCS Office, shows there to be over 13,000 acres of land subdivided. Much of it has not yet been built upon, but has been surveyed into suburban tracts.

D 4. Page IV-20 to IV-23 (Vegetation)--When revegetating disturbed areas and tailing pond locations it is recommended that the past reclamation efforts experienced by Anaconda Minerals Company on the old chrome mine tailings pond area be reviewed. The tailings pond area was eventually reclaimed, but only after wind blown dunes had formed downwind from the site. Efforts are still ongoing to stabilize and revegetate these dunes. Attached is a report developed last winter by the Soil Conservation Service and Forest Service on this area.

Sincerely,

Glen H. Loomis
State Conservationist

Attachment

cc: Ron Batchelor, State Biologist, SCS, Bozeman

A The EIS makes the following points: (1) the presence of bluebunch wheatgrass in the skunkbush shrubland, open forest-meadow understory, and revegetated chrome tailings types; (2) the dominance of wheatgrass in portions of disturbed lands; and (3) the general paucity of grasses in the ravine aspen-chokecherry, open forest-rocky understory, Douglas-fir forest, and lodgepole pine forest types. Bluebunch wheatgrass and spike fescue are not mentioned elsewhere because they constituted less than 1 percent of the vegetative cover (Camp, Dresser and McKee, 1981).

B The 340 acres originally purchased by Anaconda Minerals is referenced in the EIS in the analysis of the SMC project impact on housing in Stillwater County. Company development of homesites on the 340 acres is one of the potential mitigating measures. The land use section also notes that up to 41 acres of agricultural land could be converted to residential uses if each of the mine-related households moving into the county were to build a new home on agricultural land. This impact is not significant. However, the county could take steps to control development by implementing zoning regulations if residents perceive a need to preserve agricultural land.

C Comment noted, thank you.

D The agencies have used past experiences at this site as well as at other mines to evaluate the company's proposal. It is assumed that the company's reclamation staff would do the same. Note that, contrary to your report, the old chromite tailings was never topsoiled. Because soil will be salvaged and replaced at the proposed tailings site, the stability problems that have been encountered at the old chromite tailings site are not expected to occur at the proposed site.

LETTER #22

Kit Walther, Chief
Enviromental Analysis Bureau
Capital Station
Helena, Mt. 59620

June 16, 1985

RECEIVED
JUN 17 1985
STATE LANDS

Dear Mr. Walther,

I would just like to make a few comments + points of view which I have on the Stillwater Mining Co. EIS. We live about a mile from the Stillwater Mining office + the most important thing to us is proper handling of a mining project so our home + property doesn't depreciate or go down in value. Also we feel it is important to restore the land so there isn't a mess like there was when we moved up here 13 yrs. ago. We took moving films of the dust from the settling ponds blowing + it would blaze our home's siding + I would find it in our window sills + even in the house in the Dryer. So you can image how it effected our breathing + lungs. In the study

Your comments are noted. Thank you.

LETTER #22

② the wind blows around 100 m.p.h. + gust + is very severe. That is why personally I would perfer a Slurry line and alternative 4 at the Hertzler. I realize the cost would be more but it would be better. I feel there is less wind there + all the mony that was spent for reclaiming would be wasted because it finally is looking good + the animals (wild) mule deer + sheep are grazing on it + its doing great + looking great + the wind isn't blowing it all over us. It also would be away from the Stillwater River + not effect ground water + have discharges. I feel they should but safety of people + animals first + be sure to have mony to restore + reclaim + settle any claims against them + fix any problems that arise. Also trucking down this highway would cause more damage to the road + it would need a better highway then what we have. Just trucking out the Chrome was too heavy + caused breakups + holes. The road isn't good enough

LETTER #22

③ so either it should be rebuilt or a railway system or something would be better. I don't feel that our wildlife would be threatened because I've watched the animals & the mining they have done so far has caused no problem they still travel through graze & are here.

Other then that I believe with proper management the mining would be good for economy & our community. We just must be prepared for extra kids in school, taxes & roads & take care of our River Wildlife & Water & Air.

We need a growing economy.

Sincerely

Judita Degele
Rt 2 Box 375
Nye, Mt. 59061

LETTER #23

MONTANA CHAMBER OF COMMERCE
P.O. BOX 1730 • HELENA, MONTANA 59624 • (406) 442-2405

June 12, 1985

RECEIVED
JUN 17 1985
STATE LANDS

Mr. Kit Walther
Chief, Environmental Analysis Bureau
Montana Department of State Lands
Capitol Station
Helena, MT 59620

Dear Mr. Walther:

This letter is written in support of the Stillwater Mining Company's Stillwater Project.

A Montana is a natural resource state and our best hope for a stable economy depends on development of those natural resources. This state has lost some 7,000 basic industry jobs since 1979 and mines such as the Stillwater Project are an important step toward rebuilding. The 200-300 jobs at the mine itself would have a far-reaching positive impact on the area and the state. Placing all mine facilities for a former mine site, and digging an underground mine, both lessen any adverse environmental impact.

Further, the nature of platinum and palladium, their scarcity and importance, and the potential size of the Stillwater Project should cushion against the vagaries of worldwide competition that have created serious problems for other mining and milling operations in Montana.

B In the production system discussion, the additional expenses created by the Alternative 4 pipeline concern us. Contrary to the statement on page I-9, the company has stated that Alternative 4 would add considerably to the cost of the project (Les Darling, Great Falls Tribune, April 23, 1985). If both systems are acceptable, as the DEIS states, the company should not be subjected to the additional expense of the Alternative 4 production system.

We respectfully urge expeditious approval of the Stillwater Project.

Sincerely,

Forrest H. Boles
President

FHB/ssg

A Comment noted, thank you.

B Although the proposal and alternative 4 (as they were analyzed in the draft EIS) are acceptable, alternative 4 is superior to the proposal as originally presented. When DSL originally requested cost information on the alternatives, the company indicated that all alternatives were economically feasible. Differences in the costs of the alternatives were considered in the agency's selection process only in regard to the public benefits derived by the additional cost. In the case of the proposal and alternative 4, alternative 4 offered a noticeable environmental advantage at costs similar to the company's proposal. (Please note: Because the company has changed its mine plan, alternative 4 has been deleted in the Final EIS (see Preface). Alternative 6, however, is still retained in the final EIS, but is now called alternative 2.)

LETTER #24

RECEIVED
JUN 17 1985
STATE LANDS

June 10, 1985

Mr. Walther:

We were unable to attend the hearing in Absarokee May 15 on SMC's EIS.

We am truly upset about the proposed closure of road 846. Listed below are our reasons opposing

A 1. It would greatly increase the traffic on the Picket Pin Road, which we would be using everyday to take children to school. From this standpoint alone we feel that leaving the road the way it is is valid. The increased traffic on the Picket Pin road, which already is not a very good road would be very dangerous & unsafe.

B 2. If SMC is going to run such a clean operation they should be happy for the public to see the operation. We feel moving the road will allow the mining company to hide alot of things the public should be able to see.

C 3. The road change will greatly effect the movement of the elk herd in the spring when they calve & also in the winter in the elk wintering areas.

4. We truly hope that it is left the way it is. We feel the mine is going

A The increase of traffic on Picket Pin Road should be relatively insignificant. Most of the increase would occur in the summer months and on weekends when school is not in session. The county could post school bus crossing and warning signs along the road to alert motorists to the presence of children and school buses along the route to promote safety. The agencies EIS have chosen FR 846 as the preferred alternative in the final (see Chapter I).

B Using the Picket Pin Road would not allow the company to hide its operation from the public. The project would be visible from FAS 419 and other areas nearby. In addition, the regulatory agencies would make routine inspections of the operation.

C The EIS discusses the impacts of the road on elk. Significant impacts on elk are not anticipated due to the small amount of habitat disturbed and the slight traffic increase. Ward et al. (1976) indicate that unpaved logging and recreational roads do not hinder the movement of elk.

to impact the local area enough without spreading the impact all over the whole area.

D As for the milling and tailings we would like to see them stay right at the mine site. Keep the mess in one spot as that area is already scarred from previous mining.

E We would also like to see the workers transported to the mine & mill site by bus. The two roads coming to the Nye area from Absarokee are in bad shape and much additional traffic would be a safety hazard. Both the above roads are school bus routes for 9 months out of the year. For that one reason we feel that some sort of commuter system should be used.

In closing we hope these above ideas are considered & looked at in depth.

Paul & Cathy
Donohoe

D Comment noted, thank you. Please note that the agencies' preferred alternative locates all facilities at the minesite. See chapter I, Preferred Alternative.

E Please see the agencies' preferred alternative (Introduction and Chapter I). The preferred alternative would require the company to achieve a traffic reduction target equal to 30 percent of its work force.

United States Department of the Interior
OFFICE OF THE SECRETARY
OFFICE OF ENVIRONMENTAL PROJECT REVIEW
Denver Federal Center, Building 67, Room 488
P.O. Box 25007
Denver, Colorado 80225-0007

LETTER #25

June 14, 1985

IN REPLY REFER TO:
ER 85/679

RECEIVED
JUN 17 1985
STATE LANDS

Mr. David Filius
Forest Supervisor
Custer National Forest
U.S. Department of Agriculture
2602 1st Avenue North
P.O. Box 2556
Billings, Montana 59103

Dear Mr. Filius:

This is in response to the request for the Department of the Interior's comments on the draft Environmental Statement (EIS) for the Stillwater Mine Project, Stillwater Co., MT.

Water Resources

A The draft statement should address in detail the problem of dewatering accumulating tailings. It is not clear how dewatering of both the tailings and the dam is to be effected in the presence of the liners without an underdrain system.

B The type of sewage treatment and disposal planned should be discussed and effects assessed.

C Baseline analyses of upgradient ground water in the vicinity of the proposed mine and mill facilities should be included in the statement; and at least a representative analysis of the ground water draining from the mine is needed.

Fish and Wildlife Resources

D We believe the draft adequately describes impacts that are likely to occur to fish and wildlife resources as a result of construction of the various alternatives being considered. The U.S. Fish and Wildlife Service (USFWS) analysis of data contained in the Draft Environmental Impact Statement (DEIS) supports the agencies' determination that Alternative #4 Production System with Hertzler Valley tailing impoundment is the environmentally superior alternative. Therefore, USFWS recommends that Alternative #4 be selected as the preferred production system in the FEIS.

The following specific comments address errors, omissions or inconsistencies that should be considered during preparation of the FEIS.

A Without an internal drain system, the tailings in a lined pond would remain saturated as long as the the liner did not fail. Eventually, the liner would fail (after 30 years). If the pond could not be adequately dewatered after mining, the failure of the liner could cause saturation of the dam. Since the company's proposed plan for dewatering the tailings was an unproven technology, there would be a potential for unsuccessful dewatering and the dam becoming saturated at some time after reclamation. Saturation of the dam could adversely affect the dam's stability. Prolonged saturation could also adversely affect stability of the reclaimed surface and therefore, success of reclamation. Addition of an underdrain system would provide a tested system of dewatering the tailings at the end of mining. Thus, the underdrain system would improve postmining stability of the dam and long-term reclamation.

The company has included an underdrain system in the revised tailings pond design (see chapter II).

B The location of the sewage treatment facility is depicted on figure II-7. The facility would have to be built to meet Stillwater County standards. The preliminary design specifications for this facility call for a capacity to treat 5,000 gallons per day, an average of 3.5 gpm of wastewater. This small amount of water would be masked by the large flow of ground water (more than 1,000 gpm). In addition, the distance to the nearest well would be quite far (over 4,000 feet) (figure III-4). Consequently, alluvial groundwater quality would be unaffected.

C Following is a table listing average water quality data for 6 monitoring wells and the Minneapolis Adit discharge (AMA). Discharges from three abandoned mine adit discharges near the proposed SMC Mine are also listed for comparison. As the draft EIS states, the quality of the Minneapolis adit water is as good as surrounding alluvial waters.

D Comment noted, thank you.

LETTER #25

E 1. The Forest Service initiated formal consultation with the Endangered Species Office of the USFWS on effects of the proposal on the endangered peregrine falcon and bald eagle in correspondence dated April 29, 1985. The FEIS should acknowledge the status and/or results of the consultation.

F 2. Page I-5 and I-6: Statements regarding effects of noise levels at the Hertzler site on possible peregrine falcon nesting with development of Alternative #4 are inconsistent. No disruption is predicted on page I-5. However, Table I-2 on page I-6, contains a prediction of interference with potential nesting. This inconsistency should be corrected following completion of consultation with USFWS.

G 3. Page IV 42: The mountain ladyslipper is incorrectly identified as a threatened or endangered plant species. There are no listed or proposed endangered or threatened plant species in Montana.

H 4. The DEIS predicts increased pressure on fishery resources in the project area as a result of increased population. Monitoring of gamefish population and fisherman use is suggested as a mitigation measure. The USFWS believes that pre and post studies of this type are necessary and should be funded by the project developer.

I 5. The DEIS coverage should be expanded to include discussion of impacts, if any, occurring from transportation to and storage of the mine concentrate at Columbus, Montana.

Sincerely,

Robert F. Stewart

Robert F. Stewart
Regional Environmental Officer

cc:

Mr. Dennis Hemmer, Commissioner
Montana Department of State Lands
Capitol Station
Helena, MT 59620

E The final EIS contains the determination of the U.S. Fish and Wildlife Service.

F Comment noted, thank you. Note that Chapter I has been revised as a result of SMC's application amendment. Table I-2, as presented in the draft EIS, has been deleted.

G Comment noted, thank you. In 1983 the mountain ladyslipper was relisted as a Category 3C species. Category 3C is composed of those taxa that have proven to be more abundant or widespread than was previously believed or those taxa that are not subject to any identifiable threat (U.S. Fish and Wildlife Service, pers. comm., July 1, 1985). The mountain ladyslipper is not discussed in the final EIS.

H Comment noted, thank you. Please see the mitigating measures for the preferred alternative in chapter I.

I The company does not anticipate stockpiling concentrate at Columbus. The concentrate would be shipped by truck or by train from either Columbus, Laurel, or Billings. If the material were to be stored at the trailhead, it would be packaged in drums or other small containers to prevent losses of high-value material. Truck transportation of the concentrate to Columbus would have little impact. At full production, only one round trip per day is anticipated between the minesite and Columbus.

Mean Values for Ground Water Quality

Constituents	MW01	MW02	MW05	Ave MW06 MW07 MW08	D	AMA	MVA5-S	MA-S	VCA-S
# of Samples	(20)	(13)	(1)	(3)	(4)	(39)	(4)	(4)	(2)
Temperature (°C)	9.3	9.6	8.4	7.3	6.3	10.1	3.4	7.8	9.8
pH (S.U.)	7.94	8.12	8.11	7.7	7.40	8.17	8.11	7.18	6.41
Specific Conductance (mhos)	354.0	304.5	270.5	95	143.0	277.2	166.3	395.0	489.7
TSS (mg/l)	<1	<2	6	4	<12	1044.0	<6.0	<9.0	23.0
TDS (mg/l)	264.5	219.0	183.0	95	122.0	176.5	210.3	329.0	442.0
Turbidity (JTU)	a	a	a	-	3.4	a	0.5	3.9	161.5
Total Alkalinity (mg/l as $CaCO_3$)	186.0	177.0	164.0	57	74.0	105.4	89.5	71.0	11.0
Total Acidity (mg/l as $CaCO_3$)	a	a	a	-	<5.0	a	<5.0	<1.0	8.0
Hardness (mg/l)	215.8	198.0	173.0	56	98.0	107.8	141.3	194.0	299.5
SAR	a	a	a	-	0.13	a	0.39	0.79	0.265
Aluminum (mg/l)	a	a	a	<0.1	<0.5	a	<0.5	<0.5	6.75
Ammonia (NH_4)	<0.05	<0.08	<0.04	<0.013	<0.20	<0.74	<0.23	<0.20	<0.20
Arsenic (mg/l)	<0.005	<0.004	<0.004	<0.005	<0.003	<0.000	0.004	0.004	<0.012
Barium (mg/l)	<0.04	<0.04	<0.4	<0.5	<0.2	a	<0.7	<0.2	<0.2
Bicarbonate (mg/l as HCO_3)	226.3	214.0	198.0	70	90.0	128.0	110.0	85.0	12.5
Boron (mg/l)	a	a	a	<0.1	<0.1	a	<0.1	<0.1	<0.15
Cadmium (mg/l)	<0.001	<0.001	<0.001	<0.005	<0.008	<0.002	<0.008	<0.008	<0.006
Calcium (mg/l)	31.3	23.8	20.6	11.7	21.9	31.1	21.4	36.5	51.4
Carbonate (mg/l)	0.03	1.0	0.4	-	a	0.2	a	a	a
Chloride (mg/l)	14.1	5.0	2.0	2.7	<3.0	4.0	<3.5	<3.0	<3.0
Chromium (mg/l)	0.079	0.074	0.047	<0.02	<0.018	a	<0.030	0.022	<0.030
Copper (mg/l)	<0.030	<0.010	<0.010	0.013	<0.028	0.016	<0.025	<0.025	<0.760
Fluoride (mg/l)	<0.04	<0.04	<0.06	0.107	<0.10	0.00	<0.13	<0.20	0.10
Iron (mg/l)	<0.050	0.470	1.753	0.107	0.473	0.140	<0.160	0.627	0.680
Lead (mg/l)	<0.010	<0.011	<0.011	<0.02	<0.005	<0.014	<0.005	0.005	<0.005
Magnesium (mg/l)	33.29	33.62	29.57	6.3	9.32	7.41	20.10	22.45	31.55
Manganese (mg/l)	<0.014	<0.020	0.026	0.017	<0.033	0.000	<0.160	<0.418	1.245
Mercury (mg/l)	<0.00005	<0.00005	<0.00005	<0.001	<0.00020	<0.00006	<0.00060	0.00010	<0.00010
Molybdenum (mg/l)	a	a	a	<0.02	<0.005	a	<0.005	0.005	<0.005

Constituents	MW01	MW02	MW05	Ave MW06 MW07 MW08	D	AMA	MVA5-S	MA-S	VCA-S
# of Samples	(20)	(13)	(1)	(3)	(4)	(39)	(4)	(4)	(2)
Nickel (mg/l)	<0.010	0.010	0.010	0.02	<0.042	0.014	<0.055	<0.122	1.600
Nitrate/Nitrite (mg/l)	0.15	<1.83	<0.35	0.113	<0.10	3.00	0.33	0.37	0.93
Oil & Grease (mg/l)	NA	NA	NA	-	<2.0	NA	<1.0	<1.0	<1.0
Ortho-Phosphate (mg/l)	<0.01	<0.01	<0.01	<0.013	<0.03	0.01	<0.02	<0.02	<0.025
Total Phosphorus (mg/l)	<0.04	<0.08	<0.05	0.02	<0.10	0.09	<0.09	<0.09	0.22
Palladium (mg/l)	a	a	a	-	<0.1	a	<0.1	<0.1	<0.1
Platinum (mg/l)	a	a	a	-	<0.50	a	<0.50	<0.38	<0.5
Potassium (mg/l)	<1.70	<1.30	<1.11	<1	0.90	0.96	1.70	<1.20	1.15
Selenium (mg/l)	<0.052	<0.004	<0.004	<0.005	<0.005	a	<0.005	<0.379	<0.005
Silica (mg/l)	a	a	a	-	11.0	a	16.0	<12.0	14.5
Silver (mg/l)	<0.011	<0.011	<0.010	<0.01	<0.020	a	<0.020	<0.020	<0.025
Sodium (mg/l)	13.6	6.2	<3.4	8.7	2.8	15.2	12.0	25.4	9.8
Sulfate (mg/l)	39.4	23.0	14.0	10.3	25.0	20.02	63.3	157.0	281.5
TKN (mg/l)	<1.37	0.38	0.28	0.167	<0.36	1.24	4.0	<0.43	<0.40
Vanadium (mg/l)	0.000	0.000	0.000	<0.5	<0.079	0.000	<0.005	<0.006	<0.009
Zinc (mg/l)	0.209	<0.014	<0.016	<0.26	<0.021	0.035	<0.009	0.018	0.045
Fecal Coliform (MPN)	a	a	a	-	<3.0	0.0	<3.0	<3.0	<5.5
Total Coliform (MPN)	<1.0	a	a	-	25.0	0.0	<18.0	<926.0	<5.5

Source: SMC Permit Application, March 1984, Table 2.4-4.
a = Below detection limit.
MW01 through MWO are SMC monitoring wells.
AMA = Minneapolis Adit Discharge.
MVA5-S = Mountain View Adit #5 discharge.
MA-S = Mouat Mine discharge.
VCA-S = Verdigris Creek adit discharge.

LETTER #26

Stillwater Mining Company

A Chevron, Manville, Anaconda Partnership
Managing Partner: Chevron Resources
Star Route 2, Box 365, Nye, MT 59061
(406) 328-6208

June 17, 1985

RECEIVED
JUN 18 1985
STATE LANDS

Mr. Kit Walther
Chief, Environmental Analysis Bureau
Montana Department of State Lands
Capitol Station
Helena, MT 59620

Dear Kit,

The following are Stillwater Mining Company's (SMC) comments on the Stillwater Mining Company - Stillwater Project Draft Environmental Impact Statement (DEIS).

1.0 Primary SMC Comments

A 1.1 Preferred Alternative (pages iii, I - 4-10 etc.)

SMC proposes to locate and construct a lined tailing impoundment at the mine site using mine waste rock and earthen material excavated from the impoundment as embankment material. Although the DEIS finds this proposal to be environmentally acceptable (DEIS at I-4), six alternatives are examined in the document. On the basis of "selection criteria" listed in the DEIS, two tailing disposal sites and plans were deemed to be acceptable (SMC's proposal and Alternative 4). Alternative 4, which would require pumping the tailing from a mine site mill about 7 miles to a Hertzler Ranch disposal site was determined to be "environmentally superior".

SMC has two primary concerns with the DEIS regarding this matter. First, the language of the DEIS where discussion of the preferred alternative is unclear and, second, the evaluation of the alternative selection criteria which led to the determination that Alternative 4 is environmentally superior is incorrect.

B 1.2 Preferred Alternative Narrative is Ambiguous

The issue to which this section of SMC's comments is directed is sharply focused by the following statement in the DEIS with reference to the mine production system:

A Please refer to responses B and C.

B You are correct in that the word "select" is not used in the state and federal regulations. However, SMC's point is one of semantics. Whether the agencies identify, among an array of alternatives, a preferred alternative or "recommend" the final agency decision, the agencies are exercising a choice (or taking a preference).

LETTER #26

> Two production systems (tailing pond location and design) are acceptable: the company's proposal and Alternative 4. Alternative 4 is considered by the agencies to be environmentally superior. The agencies, after evaluating public comments on the draft EIS, will select a single preferred production system in the final EIS. (DEIS at I-4)

The DEIS is not clear as to what is intended by this statement. If the intent is to state that an environmentally preferred alternative will be identified, this is proper under applicable regulations. On the federal level, 40 CFR 1502.14 requires that agencies in environmental impact statements "identify the agency's preferred alternative or alternatives". Under DSL's regulations, the department in a draft environmental impact statement is to include a description of reasonable alternative actions that could be taken and the proposed agency decision (Sec. 26.2.605 ARM). The final EIS is to include "the department's recommendation for the final agency decision on the proposed action, where appropriate." (Sec. 26.2.607 ARM). The word "select" as used in the quoted statement is not clear and is not used in the applicable regulations. In the final EIS, this word should be eliminated. Language consistent with the regulations should be substituted to clarify the present ambiguity.

C1 1.3 Evaluation of the Alternative Selection Criteria is Incorrect

The DEIS (pages I-4 through I-9) attempts to measure both the SMC proposal and Alternative 4 against ten listed "selection criteria". As written, the DEIS discussion does not show Alternative 4 to be clearly "environmentally superior" although the DEIS without explanation concludes that "Alternative 4...meets more selection criteria than any other alternative or the proposal." (DEIS at I-5)[1]. With the corrections, clarifications and additional facts presented in the following comments, it becomes clear that Alternative 4 is, in fact, not environmentally superior and probably not even environmentally equal to SMC's proposal. Moreover, Alternative 4 is significantly more costly. Consequently, there is no rational basis for rejecting SMC's proposal in favor of Alternative 4.

C1 **We believe our general assessment of the various alternatives to be valid (see the following responses to comments); however, the company's revised operation plan (revised after the publication of the draft EIS) has alleviated some of the agency's original concerns over the tailings disposal system.**

1/ A reading of the DEIS as a whole gives the impression that an important factor underlying the preference of the Agencies for Alternative 4 is the fear that SMC's proposed tailing impoundment which is closer to the Stillwater River might fail from improper construction or design, earthquake or flood and thereby cause a discharge of tailings into the river. However, a fair reading of the DEIS indicates that this risk is minimal. With reference to the SMC proposal, dam stability is projected to exceed safety standards (DEIS at I-8); no faults were identified that could cause earthquakes of sufficient magnitude to damage the impoundment (DEIS at IV-7); and SMC's proposed location for the tailing impoundment was located outside the 1,000 year flood plain of the Stillwater River and outside the 100 year flood plain of Mountain View Creek (DEIS at IV-12).

1.4 Selection Criteria Evaluation

The following are SMC's comments on the selection criteria as they properly apply to the two tailing systems.

C2 1.4.1 Dam Stability: The stability of the tailing dam proposed for the minesite (SMC's proposal) which would be constructed from waste rock and earthen material would be greater than the stability of the dam used in the Hertzler Ranch alternative site evaluation (a centerline, cycloned dam constructed from the coarse fraction of tailing). Earthen/rock fill type dams constructed by the downstream method are inherently more stable than centerline dams constructed from tailing sands.

The DEIS states on page I-5 under Dam Stability: "The Hertzler Valley tailing disposal site is hydrologically and geologically favorable for the construction and operation of a cycloned coarse-sand tailing dam". This statement may be true if one were comparing the placement of the same dam design at both locations. The mine site disposal plan submitted by SMC incorporates design features that more than offset the hydrologic and geologic advantages reportedly intrinsic to the Hertzler site as well.

C3 1.4.2 Impoundment Spill Control: Based upon hydrologic, geologic and engineering considerations, the proposed mine site tailing dam construction plan would have less spill potential than the tailing disposal plan for Hertzler Ranch. The mine site dam will be constructed using a stable design, it will be lined, and SMC agrees to install the French drain system as discussed below. The arbitrary criteria of "proximity to Stillwater River" should not be used independently from design and safety standards and environmental protection laws and regulations. Spills from the impoundment could only occur if the waste rock and earthen dam fails or the synthetic liner has a massive failure. The potential for either of these events occurring is remote and would only result from a large seismic event near the facility. A seismic event large enough to rupture the impoundment would likely cause significant landsliding all along the Stillwater River such that the tailings impoundment's proximity to the river would be inconsequential when compared to the regional impacts of sediment loading into the river.

Minor slumping in the embankment, again although unlikely, could be corrected as easily at the mine site as it could be at the Hertzler Valley site. In fact, since the mine site facility would be under around-the-clock supervision, any slumping or potential dam problems would be readily noticed and corrected. The chances of any dam material or tailing material entering the river are negligible.

C2 The criteria were developed to test the suitability of each alternative tailings impoundment location and not the stability of the different dam designs. In the EIS, both the Hertzler Ranch and minesite were considered suitable sites for construction of the respective dam designs. We agree that earthen-rock fill dams constructed by downstream methods are inherently more stable than centerline dams constructed of cycloned tailings. However, both designs would meet or exceed dam safety standards. The terminology has been revised in the final EIS to more accurately describe the criterion.

C3 The agencies agree with SMC's assessment. However, we maintain that the criteria of "proximity to the Stillwater River" are not arbitrary when the following facts are considered: (1) environmental laws and regulations apply equally to both sites, and (2) both impoundment designs would meet or exceed dam safety standards. Discounting the potential risk for dam failure, which would be low in both cases, the obvious difference between the two impoundment alternatives is the ability to control seepage and spills which then becomes a function, to a large part, of distance. Given its distance from the river, the Hertzler site would provide better control.

C4 The quality of ground water surrounding the mine site impoundment would be monitored on a regular basis. In the unlikely event that ground water quality changes required mitigating, it would be possible to intercept such adversely affected ground water and either return it to the process water circuit or treat it prior to disposal. The same requirements would be applied to a Hertzler Valley ranch site. The only differences between the two sites would be the amount of time available to mitigate an adverse impact. In either case laws and regulations protect the quality of the river.

Considering both the extreme unlikelihood of a spill with the proposed mine site tailing impoundment design and the availability of clean-up techniques in the event of spills, "impoundment spill control" is as good at the mine site as for Alternative 4, if not better.

Under the heading Spill Control on page I-8 and elsewhere, the DEIS states that the SMC proposed tailing design for the mine site would be required to install "an underdrain system on the floor of the impoundment with a collection and pump-back system" as a leakage control system. At page IV-7 the DEIS states that the proposed tailing dam design may: "...present problems because there is not provision for an underdrain system to de-water the tailings and protect the dam from saturation and possible subsequent failure, particularly over the long term".

We are now planning to install a French drain system in the impoundment bottom to, primarily, allow the drawdown of the phreatic surface in the impoundment at closure such that tailing impoundment reclamation can be more readily accomplished. We plan to add this underdrain system consisting of a system of finger drains utilizing perforated piping installed in a sand bed because of our recent conclusions that many, if not all, of the underground stopes will require sand fill (made from the coarse fraction of the tailing). The fine fraction of the remaining tailing stored in the impoundment would be difficult to de-water without such a drain system.

The French drains above the liner are planned to be operated only during the initial reclamation activities after mine closure. They could be used to reduce the water level in the impoundment in the unlikely event that water levels in the embankment rise to the point of threatening dam stability. The drains could also be used as leakage control devices in the unlikely event of liner failure.

C5 1.4.3 Slurry Line Rupture: The DEIS claims that the 7-mile slurry line to Hertzler would have low risk of rupture and that adequate safeguards could be designed into the line to minimize the risk of rupture and immediately control a spill. The risk of rupture of a tailing line is greater than the risk of tailing dam failure at the mine site. A tailing slurry line would also be subject to plugging and leaking. Further, the tailing line, following the FAS 419 and FAS 420 right of

C4 SMC's revisions have been included in chapters 1 and 2 and elsewhere in the EIS.

C5 Over 1,000 gpm of ground water flows down the Stillwater River valley adjacent to the proposed minesite. A pump-pack system could not capture all the alluvial water if it were contaminated (maximum 60-70% well recovery efficiency). Treatment of this much water would also be difficult. Conversely, the Hertzler Valley site is well suited for recycling seepage; the site is underlain by impervious Colorado shale and the thin veneer of overlying glacial material contains very little natural ground water.

Also note that on page I-8 the agencies clarify that an underdrain system would provide an adequate leakage-control system for the proposed impoundment at the minesite. Because SMC made this design revision after the publication of the draft EIS, changes have been made in the final EIS (see chapters I, II, and IV).

LETTER #26

way, would generally follow the Stillwater River, exposing the river to the possibility of receiving a discharge of tailing over about a 5 mile distance. The proposed site exposes about only .5 mile to potential spills. The same statement that "adequate safeguards could be designed into the line to minimize the risk of rupture and immediately control a spill" (page I-5, Slurry Line Rupture) should be made about the risk of tailing dam failure at the proposed mine site tailing location. Our proposed design incorporates more than adequate safeguards for spill control by utilizing a safe and stable design and monitoring.

C6 1.4.4 Reclamation Success: SMC accepts the suggested additional requirement for installation of an underdrain system above the tailing liner to provide for tailing dewatering after mine closure and for potential use for leakage control at the mine site. Finger drains constructed of perforated piping embedded in sized sand will be incorporated in our tailing impoundment at the mine site. The potential for reclamation success for either alternative is equally good. The costs for reclaiming Alternative 4 would be greater since both the mine site disturbance area and the tailing site would need to be reclaimed.

C7 1.4.5 Expansion Potential: The mine site tailing disposal site is projected to have a life of at least 20-25 years even if the entire tailing stream is disposed of at this site. Our current understanding of the necessity of using a portion, if not all, of the coarse tailing underground for fill would effectively expand the life of the proposed site well beyond 30 years. There is, however, no basis for making a decision regarding preferred alternative selection on such an arbitrary criteria that one must have 30 years of life at a disposal site. Most ore bodies in the world have mineralized rock that under the right circumstances of metals prices and mining costs would allow for extending a mine's life. There is no basis for deciding that a 30 year site is better than a 10 year or 50 year site. SMC believes that its proposed site is adequate to support a commercial mine for as far into the future as we can reasonably predict. If circumstances change during the project's predicted life and additional tailing disposal area is needed, such an expansion would be subject to the same environmental review scrutiny as is the presently proposed site. For these reasons, the use of "expansion potential" as a selection criterion for preferred alternative selection is improper.

C8 1.4.6 Cost: The DEIS claims on page I-8 that: "The cost of Alternative 4 would range between \$8.0 - \$10.5 million. Given the level of accuracy (±20-40%) of the cost estimates, Alternative 4 is similar to the proposal ($7.3 to $9.4 million)." On page I-9 the DEIS states that: "...the cost (for the SMC proposal) would be in the same range as for Alternative 4".

C6 Comment noted, thank you.

C7 The fact that "most ore bodies in the world have mineralized rock that, under the right circumstances of metals prices and mining costs, would allow for extending a mine's life" is the basis for using the "expansion potential" criterion. Capacity at SMC's proposed site (as described in the draft EIS) is finite and limited to the project life. Sites that offer additional capacity have obvious environmental advantages (for example, fewer disturbance acres, lower aesthetic impacts, and less pollution liability). The criterion has been deleted for the final EIS for reasons described in the Preface.

C8 The cost estimates used in the DEIS come from two sources--SMC and the U.S. Department of the Interior, Bureau of Mines (BOM). The BOM cost estimates varied in some instances with those of the company. The BOM cost estimates for alternative 4 were lower than either the SMC or BOM estimate for the proposal. Because of the substantial variability between SMC and BOM estimates and because of the low level of accuracy, costs of alternatives were expressed as a range using BOM and SMC data.

The range of costs can be compared because although the unit costs may be higher or lower than estimated, the amount of activity per unit cost may be incorrect. For example, the amount of excavation for an alternative and therefore the cost may change as project engineering and planning become more specific. So it is not inaccurate to compare ranges of costs. If only the per-unit cost were to vary and not other parameters, then it would be incorrect to assume that the ranges of costs are comparable.

C8 SMC disagrees with these conclusions. Alternative 4 would add significant costs to the project for which there would be no tangible public benefit. SMC provided an analysis of costs for these alternatives in June, 1984, which estimated that the present worth cost of Alternative 4 was $10.48 million as compared to a present worth cost for the mine site tailing disposal site of $7.27 million. While the level of accuracy was given as ±25-40% it is not correct (in statistical analysis or in this case) to assume that these costs are the same because the ranges overlap. The level of accuracy percentage indicates that actual construction costs may be as much as 25-40% more or less than the estimate. However, actual costs for both sites would likely be either higher or lower than the estimates in the same direction. That is, if the earth moving unit costs used in the estimates prove to be low they would be low for both estimates. It is not correct to assume that the costs for Alternative 4 and the SMC proposal would be equal. Alternative 4 presents substantial additional costs to the proposed operation and technical and engineering problems as well.

As previously stated, SMC has found during its recently concluded underground exploration and mine feasibility studies that many, if not all, of the underground mine stopes will need to be mined using cut and fill mining methods as opposed to shrinkage stoping methods previously thought to be feasible. Cut and fill mining will be necessary to control mine dilution from waste rock from hanging wall and footwall spalling. The fill material to be used in the stopes will be obtained by separating the coarse fraction of mill tailing and pumping it back to underground stopes.

The environmental advantages to placing about one-half the tailing underground would include mitigation of potential crown pillar collapse problems and reducing the volume of tailing placed on the surface. These advantages are recognized in the DEIS.

The importance of this mining method to tailing disposal alternative review is that about 50% of all tailing would be placed underground. This material will be the coarse fraction of the tailing stream and placing it underground would prevent its use as tailing dam construction material. The cost used in the DEIS for Alternative 4 (tailing disposal at Hertzler) was developed assuming that the impoundment dam could be constructed by using the coarse fraction of tailing in a centerline, cycloned dam. Using a cut and fill mining method would preclude the construction of a centerline, cycloned dam; therefore, an earthen dam would have to be constructed at Hertzler to contain the tailing. An earthen dam would be substantially more expensive than a centerline, cycloned dam.

SMC recently commissioned an engineering consulting firm (Internat-ional Engineering Company) with tailing impoundment design and construction management experience to re-estimate the cost of Alternative 4

The EIS has been revised to reflect SMC's revision in the proposed mine plan application (July 25, 1985). The proposal in the final EIS is now described as a cut-and-fill method of mining (backfilling the stopes with the coarse tailings fraction). Essentially, alternative 1 described in the draft EIS has become the proposal in the final EIS.

We agree that SMC's plan to backfill about 50 percent of the tailings would make alternative 4 unfeasible since the coarse-fraction tailings would be unavailable for dam construction.

We assume the cost re-estimation report that you reference is the same report that Morrison-Knudsen Engineers, Inc. (MKE) prepared for SMC (June 17, 1985). This new report, in addition to a one-page, revised estimate for the minesite tailings disposal costs (using cut-and-fill mining) was submitted to the agencies on July 25, 1985. The MKE report re-estimates the cost for the Hertzler Valley disposal site and backfill alternative (described as alternative 6 in the draft EIS). Comparison of the new cost estimates with SMC's original estimates (used in the draft EIS) shows that the relative difference in project costs between the minesite and Hertzler Valley site (using cut-and-fill mining) do not vary. The relative difference between the two sites is 3.6 million in net present-value dollars. On the other hand, a comparison of the new estimates with the original estimates suggests that the estimated cost for the Hertzler Valley site may be cheaper than originally estimated, thus resulting in a noticeably smaller difference between the two alternatives. Our review of SMC's information does not substantiate that the Hertzler Valley site would cost $5 to $7 million more than SMC's revised proposal (cut-and-fill mining with the tailings pond at the minesite). Three of the four items SMC lists in its comment letter to be responsible for the increased difference in cost were considered in Morrison-Knudsen's revised cost estimate report.

While MKE's Cost Estimation report notes that a slurry pipeline to Hertzler Ranch lacks flexibility, it does not conclude that there would be major engineering and operational problems. The agencies acknowledge that this alternative would combine higher capital and operational costs. However, these higher costs must be weighed against the environmental benefits of the alternative.

C8 with the use of an earthen embankment at the Hertzler site. Their cost estimate for Alternative 4 tailing location when compared to the SMC estimate for the proposed mine site tailing disposal site (using the cut and fill mining approach) shows that Alternative 4 would cost from $5 to $7 million more than SMC's proposed mine site disposal plan on a present value basis.

The major reasons for this difference, which is even greater than the difference estimated in June, 1984, between the two sites, are:

-- the major capital costs for the Hertzler site are the tailing pipeline and pumps and water reclaim line and pumps, which need to be installed immediately. Only minimal piping and pumping would be required for the mine site disposal plan.

-- two small emergency disposal ponds would be necessary, one at each pump station, to allow dumping of the contents of the pipeline in shutdown conditions. (Tailing could not be allowed to stand in a pipeline for more than a few minutes or the entire line would be plugged.) These emergency ponds would not be necessary for a mine site disposal site.

-- routing a pipeline along the road right of way would be difficult and expensive because of terrain problems. (In estimating the cost of Alternative 4, we assumed that the road right of way would be available at no cost. We also assumed that land would be available for the pump station and emergency dump pond.)

-- increased operating costs are incurred in pumping the tailing to Hertzler.

There would be major engineering and operational problems with constructing and operating a slurry pipeline and water reclaim pipeline to Hertzler ranch that are not incurred with the mine site tailing disposal system as proposed by SMC. Placing tailing at Hertzler through a slurry pipeline limits the flexibility in operating the mine at various production levels. The pipelines would need to be operated at design flow rates at all times to prevent plugging. SMC expects it will be necessary to start operations at less than the 1,000 ton per day (tpd) milling rate with expansion to a 1,000 tpd, and perhaps beyond, in later years. One slurry pipeline could not be used for these differing operating rates. Therefore, difficult and expensive slurry line modifications would be needed if the Hertzler disposal site is used.

Placing tailing at the minesite allows for considerable operating flexibility which, while not easily accounted for in cost analysis, is extremely important in starting a new mining operation with the geologic, engineering and marketing uncertainty facing SMC.

C9 1.4.7 Other Wildlife: (same for both)

C9 **Comment not clear.**

LETTER #26

C10 1.4.8 Threatened and Endangered Wildlife: (same for both)

C11 1.4.9 Public Safety: Average daily traffic on FAS 419 would not be the same for the proposal and Alternative 4. Alternative 4 would require frequent trips between the mine site and the Hertzler tailing disposal site for tailing site and pipeline operations and maintenance. Furthermore, considerable traffic disruption along FAS 419 and 420 would be necessary during the installation of the slurry pipeline as well as for pipeline repairs and maintenance.

C12 1.4.10 Visual Resources: The conclusion that visual resources would be affected less if Alternative 4 were selected is erroneous. The need to store waste rock at the mine site plus the need to have a 10-15 acre emergency tailing disposal site at the mine site would create a visual impact not unlike the proposed tailing impoundment (which incorporates waste rock into the embankment). In addition to this visual impact, Alternative 4 would present the visual impacts associated with the slurry line, including two emergency tailing ponds and pump stations, as well as the tailing disposal site at the Hertzler ranch.

D 1.5 Conclusion

In identifying their preferred tailing disposal alternative, the agencies must carefully study alternatives in the context of the entire production system. All relevant considerations, including both environmental factors and relevant costs, must be weighed and balanced. The EIS must balance the benefits and environmental costs of the proposed action against each reasonable alternative to determine the course of action which affords the "best net balance". The "rule of reason" is the standard which must guide this process.

When the substantial additional costs of Alternative 4 are balanced against the lack of a clearly demonstrated environmental advantage, the "best net balance" clearly favors SMC's proposal and the "rule of reason" dictates the identification of SMC's proposal as the preferred choice. The DEIS agrees without argument that SMC's proposal is acceptable (DEIS at I-4). This can only mean that the agencies have found that SMC's tailing system would meet all requirements of environmental laws and regulations. In this regard, it is not necessary for SMC to belabor the fact that tailing impoundments are subject to detailed environmental and regulatory laws which are intended to assure their stability and to reduce their potential for causing water pollution and other environmental harm (e.g., the Montana Hard Rock Mining Act and regulations adopted thereunder, particularly Sec. 26.4.106(4), (14), ARM; the Montana Water Quality Act and regulations adopted thereunder, particularly Sec. 16.20.633(4) ARM; the Federal Clean Water Act and regulations adopted thereunder; and the regulations governing approval of operating plans on property managed by the U.S. Forest Service).

To reject SMC's proposal which has been carefully tailored to meet these requirements and which, in light of the agencies' declaration of acceptability in the DEIS, meets all applicable legal standards, would be arbitrary. To impose upon SMC Alternative 4 which is substantially more costly and at best affords only a speculative environmental gain would exceed the appropriate decision making power of the agencies.

C10 Comment not clear.

C11 Thank you for your comment. The text has been changed to note that traffic disruptions are greater for alternatives with slurry transport of tailings.

C12 The visual resources would be affected less with the tailings pond at Hertzler Valley even considering the 10-acre emergency pond and storage of waste rock at the minesite. The emergency pond would be substantially smaller (15 feet in height and 10 acres in size). Although nearly 1.13 million cubic yards of waste rock would have to be dumped at the minesite, it would only occupy about 40 acres and the embankment would be about 50 feet high. Even during mining the emergency pond and waste rock dump would have a lower visual impact relative to the proposal. After mining the emergency pond and waste rock dump could be blended more naturally into the existing landscape. This would not be the case with a major tailings impoundment at the minesite. The tailings pond at the Hertzler site, both before and after reclamation, would not be visible from FAS 419 and would only be seen at a distance by travelers on FAS 420; the result would be a lower visual impact relative to the minesite. Visual impacts of the slurry line, although low, would be temporary (for the life of the project). The pump stations and spill ponds associated with, the pipeline would be removed after mining. During mining, these facilities could be located in low visual impact areas.

D Thank you for your comment. We feel the agency's decision displays the "best net balance."

2.0 Secondary SMC Comments

E 2.1 Page v: Soils (Alternative 4): The last sentence of this paragraph states: "Other, more intensive, mitigating measures would have to be implemented at this site". These other "mitigating measures" should be clarified in the FEIS. We were unable to determine what this sentence was referring to from the body of the text.

F 2.2 Page v: Vegetation (Proposal): There seems to be an inconsistency in this paragraph. It is stated that plant diversity would decline in one part and then, in the penultimate sentence, that plant diversity would increase.

G 2.3 Page x: Power Corridor Alternatives 1 and 2: The last sentence indicates that the powerline would add about $3 million to the property tax base. If property tax base is intended to mean the county's taxable valuation, this estimate is too high.

H 2.4 Page IN-8: Air Quality Bureau: The paragraph is based on the premise that any mining operation would require an air quality permit. Our understanding of the laws and regulations is that certain threshold requirements must be met before an air permit is necessary. That is, the regulations require a permit unless a potential source has "...the potential to emit less than 25 tons per year of any pollutant, other than lead, for which a rule has been adopted..." (ARM 16.8.1102 (1)). While it is probably true that an air quality permit would be required for the proposed operation as contained in our Application for Operating Permit, it may not be true for a smaller-sized operation that we are likely to construct initially. The actual determination of whether or not an air quality permit is necessary will need to be made as a separate issue and the EIS should not lead the reader to automatically assume that such a permit is necessary.

I 2.5 Page IN-8: Water Quality Bureau: The first paragraph is misleading in that it states that an MPDES permit is required before "waters from the mine facilities could be discharged to state surface or ground waters". While an MPDES permit would be necessary for any discharges to state surface waters, ground waters are protected by the Montana Groundwater Pollution Control System (MGWPCS) Regulations (ARM 16.20.1001 et seq.). These rules exempt mining operations subject to operating permits under the Reclamation Act from obtaining separate MGSPCS permits. Such operations are subject to other ground water protection requirements of the rules which are administered through the operating permit.

J 2.6 Page I-15: The Preferred Road Access Alternative: SMC has committed in its Plan of Operations to design access portal sites and construct Forest Road bypass segments to accommodate both the public and mine operations uses of the Forest Road with minimal safety problems or public inconvenience. Since mine development will start in the existing Minneapolis Adit, the 5000 Portal and 5350 Portal, the potential for conflict between public uses of Forest Road 846 and mining operations in the

E The "other, more intensive" mitigating measures mentioned in the summary on page v are discussed on page IV-19. Since Hertzler-site soils could not be salvaged in two lifts due to the large quantity of stones and boulders, the addition of organic amendments is recommended to mitigate the impacts that would stem from expected low postmining water- and nutrient-holding capacities.

F Initially, plant diversity on reclaimed lands would be lower than the premining diversity. However, invasion by native plants would eventually increase diversity to near premining levels. For a more complete discussion, please refer to Chapter IV, Vegetation.

G Comment noted. Please see revised text.

H Comment noted. Please see revised text.

I Comment noted. Please see revised text.

J The potential for conflicts between public uses of FR846 and mining operations is probably greatest in the early years of mine development when construction of facilities is at its peak.

J early years is negligible. During this time SMC is willing to explore the feasibility of constructing the alternate access road (Picket Pin Creek Road to FR 846) with the assistance and cooperation of the U.S. Forest Service.

When SMC's proposal for maintaining access to the West Fork of Stillwater River is compared in the DEIS under the selection criteria listed in Table I-5 to the alternative, the alternative cannot be said to be environmentally superior. In fact, the DEIS does not purport to "choose" the alternative on this basis. Rather, it states:

> "The alternative access to the West Fork of the Stillwater trailhead was chosen because it required the purchase of the least amount of private land and would mainly require construction of abandoned roadways."

Aside from the fact that environmental considerations were not the basis for the choice, this statement appears to conflict with the discussion on page I-17-18 which indicates that:

> "Right of way would have to be acquired before Stillwater Mining Company could implement the preferred alternative."

The application of the selection criteria does not support the conclusion that the alternate access should be an environmentally preferred alternative.

K 2.7 Page III-12, paragraph 3: SMC retained the hydrologic engineering firm of Morrison Maierle to define various flood levels on the Stillwater River where it passes the proposed tailing disposal site. Their report, dated November 11, 1983, and provided to the DSL, should be referenced and incorporated into the EIS in this paragraph. It is a much more definitive study of flood flows than either of the references used.

Thank you for this opportunity to comment on the Stillwater DEIS.

Sincerely,

LA Darling
L.A. Darling
Environmental Coordinator

LAD/ld

cc: P. Jaquith, USFS

The agencies chose to consider for comparison (emphasis added) the Picket Pin Road access because it alleviates some environmental disadvantages of the proposed road access while requiring purchase of a small amount of private land and reconstruction of existing abandoned roadway. Environmental considerations were the basis for choosing the preferred alternative (see pages I-15 through I-18, DEIS).

In the final EIS, the agencies have chosen SMC's proposed road access because of the unwillingness of the private landowner to sell and the difficulty of relocating FR 140 to mitigate potential adverse effects on peregrine falcons.

K The Morrison-Maierle report has been added to the list of literature cited.

LETTER #27

Nye, Montana 59601

June 16, 1985

Kit Walther
Environmental Analysis Bureau
Reclamation Division
Montana Dept. of State Lands
Capitol Station
Helena, MT 59620

RECEIVED
JUN 1 8 1985
STATE LANDS

Dear Mr. Walther:

A I feel the Hertzler ranch site is the best site for the tailings pond, in as much as a slurry line has been included in the alternative. The pond should be lined with hypalon, and the dam should be an earthen one, with a slope not greater than 30% to assure adequate reclamation and prevent erosion. I strongly support the Hertzler ranch alternative with the slurry line and the backfill, to replace as much of the waste rock as possible. At all times, the operation should use the best technology available, as the Stillwater River is an outstanding fishery resource.

Regarding road access to the West Fork of the Stillwater River:

B Visual - I can see no problem with the visual impact on the traveling public by using the existing road to the West Fork. Many tourists and recreationists would be glad to see the only platinum/palladium mine in the U.S. Since this will be a model operation, I would think the company would welcome people seeing the operation. The existing road up the mountain to Horseman Flat and the West Fork is one of the most scenic roads in the area.

C Transportation - There are several things that are not being considered. From the junction at Carter's Camp, off the oil onto the county road, the road is a narrow, winding gravel road that is already heavily used in the summer by cabin people and their guests, weekenders, woodhaulers by the dozens, berry pickers, grouse hunters, all going to Picket Pin and Iron Mountain, plus ranchers, cement and gravel trucks, horsebackers, machinery, motorcyclists, walkers and fishermen. In addition to this is a dust problem that can cause almost zero visibility.

There are five very narrow bridges where visibility is very poor. There have been several accidents on these bridges, so adding additional travellers, who are now going up the Stillwater past the mine to the West Fork, is asking for trouble. There will be more accidents, because narrow bridges, loose horses and cattle, plus the aforementioned users cannot help but bring this about. To change this road makes about as much sense as using the highway as an ore haul road. If modification of the existing road is needed around the mine for the

A Thank you for your comment.

B Thank you for your comment.

C Comment noted, thank you. Please note that the agencies chose FR 846 as the preferred alternative (see chapter I).

LETTER #27

	traveling public's convenience, it should be the company's responsibility, since they are causing the problem.		
D	Wildlife - The idea that this preferred access will be a MINOR intrusion on elk habitat is not quite correct. The Picket Pin road goes right through the elk calving ground. I counted 49 adult elk and saw many calves in Picket Pin meadow above the road one evening about June 1st and another 15 head with calves below the road in our meadow. The more traffic on this road, the more disturbance.	D	The revised text indicates that calving grounds are present in the Bear Pen Creek-Swamp Creek area. However, this new information does not change the impact analysis. The reconstructed road would be over 1/4 mile from the calving area and traffic increase during winter and spring would be insignificant. Please see response to comment 24C.
E	Cost - It is impossible to estimate the land-acquisition costs because buying from an unwilling seller can be quite expensive. Who is building this road, Forest Service or the Company?	E	Please see letter 31, answer BB and Letter 37, answer D. The company would build the road.
F	THE FOREST SERVICE AND MONTANA DEPT. OF STA TE LANDS, AND ALL AGENCIES INVOLVED IN THE EIS SHOULD BE SURE THE BEST TECHNOLOGY AVAILABLE IS USED TO DEVELOP THIS ENTIRE PROJECT. THERE IS TOO MUCH AT STAKE IN THIS AREA TO RISK LOSING IT. INFINITE TOURIST AND RECREATIONAL USE AND DOLLARS, WHICH GROW STEADILY, PLUS THE AESTHETIC AND ENVIRONMENTAL VALUES WHICH CANNOT BE MEASURED BY DOLLARS ALONE, MUST BE TAKEN CARE OF NOW FOR SUCCEEDING GENERATIONS TO ENJOY AS A MONTANA HERITAGE.	F	Comment noted, thank you.

Thank you.

Mary Donohoe

Mary Donohoe

LETTER #28

EASTERN
MONTANA COLLEGE
1500 North 30th Street, Billings, MT 59101-0298 Department of Sociology and Political Science 406/657-2138

June 10, 1985

RECEIVED
JUN 13 1985
STATE LANDS

Mr. Kit Walther, Chief
Environmental Analysis Bureau
Reclamation Division
Montana Department of State Lands
Capitol Station
Helena, MT 59620

Dear Mr. Walther:

A I am writing this letter to strongly protest the Stillwater Mining Company's Proposal for the Stillwater Project. I also strongly protest all six alternative proposals, including the preferred alternative as described in the Draft Environmental Impact Statement, Stillwater Project, Stillwater County, Montana, April, 1985.

Last Spring my wife and I and my parents were able to buy 20 acres of land between the Castle Rock and Morraine Fishing Accesses on the Stillwater River. Neither myself and wife nor my parents are wealthy people. This purchase was a step toward our "American Dream" of owning a home where we could retire, that my parents could enjoy and that my brother, his wife, and children could visit. The purchase of this land involved the sacrifice of many other things.

The Stillwater Mining Project as well as all six alternative proposals would have adverse effects on our land, our lives, and our dreams. The preferred alternative (alternative 4) would place a tailing pond within two miles of our property.

Beyond the obvious issues of aesthetics, I am most concerned about increased traffice, road kills, impact on Big Horn sheep, on eagles, on falcons, and on the fish population. Certainly any of the proposals would completely alter the beauty of the Stillwater Valley.

As a professional sociologist, I read with interest the sections of the EIS which were entitled sociology. I was distressed by some serious omissions in these sections.

B The sociology of leisure is becoming a more and more important sub-discipline of sociology. Our society, with its emphasis on individual freedom as well as collective responsibilities, must provide its members with quality opportunities for leisure time activities. Montana, with its majestic

A Comment noted, thank you.

B The review and analysis of leisure was not omitted from the EIS, although it was not included in the sociology section. The DEIS, particularly the recreation and aesthetics sections, analyze and report leisure activities and especially outdoor recreational opportunities.

You are probably aware of the diversity of peoples' opinions regarding an issue. The SMC project is no different. Many of the people who submitted comments spoke of the need for jobs in Stillwater County. As you have noted, maintaining the quality of recreation in the Stillwater Valley is another of those concerns. The EIS process is one avenue which can be used to identify public concerns and balance development to address those issues. Mitigating measures have been suggested in the EIS that would assure continuation of quality recreation and leisure activities in the Stillwater Valley and allow the development of the project.

LETTER #28

out-of-doors has a special responsibility for leisure time opportunities. Many people own land on the Stillwater River, although they may live elsewhere. These people, such as myself, depend on the Stillwater for valued if not treasured, leisure opportunities. I saw no evidence that the opinion of these people was solicited.

In addition, many people who do not own land on the Stillwater use the river for leisure time activities. There was no evidence that the opinions of these people were solicited.

Finally, I am enclosing a copy of a report I have just completed for the Custer National Forest. It can be readily observed that Hardrock mining is a very, very unpopular activity among the respondents to the questionnaire used in the study summarized in the report.

In summarizing then:

1. As an owner of land on the Stillwater River, I am totally against any further development of mining in the Stillwater Valley. Such development would severely and adversely effect my life, my dreams and my sense of well-being.

2. As a professional sociologist, I am concerned about serious omissions in the sociology sections of the Draft Environmental Impact Statement. In particular, no attention has been given to:

- A. The deprivation of leisure time opportunity which the proposal or any of the six alternatives would cause land owners on the Stillwater.
- B. The deprivation ~~in~~ of leisure time opportunities which the proposal or any of the six alternatives would cause to recreational users of the Stillwater River who do not own land or live on the river.
- C. The importance of quality leisure time opportunities for the American society.
- D. The opinions of users of the Custer National Forest about hard-rock mining.

Thank you for your attention to this matter.

Sincerely,

Joe W. Floyd

Joe W. Floyd, Ph.D.
Associate Professor of Sociology

LETTER #29

Montana Department
of
Fish, Wildlife & Parks

1125 Lake Elmo Drive
Billings, MT 59105

June 12, 1985

RECEIVED
JUN 13 1985
STATE LANDS

Mr. Kit Walther
Department of State Lands
Capitol Station
Helena, MT 59620

Dear Mr. Walther:

The following comments on the Stillwater Project Draft EIS were prepared by fisheries and wildlife personnel of the Montana Department of Fish, Wildlife and Parks regional office in Billings.

With respect to wildlife, much of the concern is associated with the increase in the number of year-round residents to the area and their increased use of the area especially as related to increased vehicular traffic. Many of our comments revolve around the traffic issue and how to alleviate it.

A 1. We support alternative 4 wherein it requires the transportation of mill tailings in a slurry pipeline to the tailings pond site at the Hertzler Valley.

B 2. We strongly oppose closing road FR 846 through the mine site to the West Fork Stillwater River trail head and the construction of a one mile road from Picket Pin Road to this trail head. This will only aggravate an already poor situation consisting of heavy traffic across an important big game winter range.

We would, however, support the construction of the new road to the trail head on one condition; namely that the Forest Service close the Picket Pin Road to vehicular traffic of all kinds from the close of the big game season through April 15 of each year.

C 3. Much of the work associated traffic can be minimized by bussing workers from Absarokee and surrounding areas to the mill and mine site. This would reduce road kills which would be associated with extensive vehicular traffic from mill and mine workers.

D 4. The bighorn sheep population has shown a dramatic downward population trend since the initiation of mine

A Comment noted, thank you. Note that alternative 4 has been deleted in the final EIS (see Preface).

B Comment noted, thank you. The impacts of the Picket Pin Road are discussed in the EIS, Chapter IV. The discussion excludes significant impacts on elk due to the small increase in winter traffic. In the FEIS, the agencies chose FR 846 as the preferred alternative.

C The preferred alternative requires a traffic reduction plan (see chapter I).

D The EIS discusses the impacts on bighorn sheep (see Chapter IV, Wildlife). Information supplied by Youmans et al. (1982) and Stewart (1984) suggests that mining may be one of the factors affecting the bighorn

Mr. Kit Walther
June 12, 1985
Page 2

activity in recent years. This is associated with stress produced through increased traffic, especially between the mine and Beartooth Ranch headquarters, and the dispersal of the sheep from their best wintering area on and adjacent to the Beartooth Ranch.

To turn this trend around we propose, as a first step, the installation of a traffic counter on the road from the mine site to the Beartooth Ranch to document present traffic loads.

Second, initiate habitat improvements on the winter range to include burning, fertilization, seeding of highly preferred forage species such as clover, alfalfa, blue bunch wheat grass, etc.

Third, initiate an intensive monitoring program which would include radio marking sheep to document movements on or in close association with the winter range and to assist in determining changes in population size by producing population estimates. Radios would be monitored both from the ground and from helicopter and fixed wing surveys. The monitoring would occur from December-April for each year the mine is in operation.

E 5. Wildlife mitigation measures would include the following: when it has been determined that the sheep population has reached a point below which the survival of the herd is highly questionable (15 sheep), then the Stillwater Mining Company would be required to finance the cost of a sheep transplant program under the direction of MDFWP.

F Conservation easements would be granted on both the Beartooth and Picket Pin ranches to include the stipulations that both ranches would remain in agriculture with none of their holdings to be used for subdivision or residential purposes, and they would in no way be used for mining activities or mine associated activities, e.g., shops, storage, offices, etc.

Fisheries concerns also revolve around the increased population of the Stillwater valley. Our surveys indicate intensive fishing pressure is presently exerted on the Stillwater, East Rosebud and West Rosebud drainages. Fish population data gathered to date indicate a small percentage of the trout population exceeds 13 inches in length - an indication that fishing pressure may be adversely affecting the Stillwater trout population.

herd. However, this information does not conclusively demonstrate that mining is solely responsible for the herd's decline. As stated in the EIS, further research is necessary to determine the effects of mining and human activity. Any research should include (1) larger sample sizes, (2) documentation of mining and human activity, and (3) analyses of other factors affecting the bighorn herd, such as weather, hunting, predation, inbreeding, and intraspecific stress.

The preferred alternative requires the company to develop a bighorn sheep monitoring plan. The monitoring plan will be subject to approval by the Department of State Lands and the Forest Service (see Chapter I).

E The required monitoring plan will include an impact mitigation contingency plan (see Chapter 1). If land use at the Beartooth Ranch negatively affects bighorn, an appropriate mitigation will be developed. Please note, however, that SMC has indicated that land use changes at the Beartooth Ranch are not expected (L. Darling, SMC, letter to R. Fliger, MDFWP, July 10, 1985).

F The preferred alternative requires SMC to survey employees and their families as to their use of the Stillwater River. The resulting information will be submitted to the DFWP (see Chapter I, Preferred Alternative).

LETTER #29

Mr. Kit Walther
June 12, 1985
Page 3

As stated on page IV-29 of the draft EIS, fish populations and fishing pressure should be monitored to provide the information needed to adjust management strategies to protect and maintain fish populations and fishing opportunities. Stillwater Mining Company should provide funding for a creel census of the Stillwater drainage prior to the onset of mining activity and after activity has begun. The Company should also provide funding for annual monitoring of trout populations and rainbow trout spawning in the vicinity of the mine.

G We are also concerned about possible increase in fine sediments in the Stillwater River streambed. The reach of river near the mine site and extending downstream for several miles constitutes extremely important spawning and nursery habitat for rainbow trout in the lower Stillwater and Yellowstone rivers. Addition of fine sediments can significantly reduce survival of trout eggs and insects. Consequently, we suggest the Company be responsible for monitoring sediment composition of the Stillwater River above and below the mine site. Sites above and below the slurry line crossing of the West Fork Stillwater River should also be monitored. This work could be done by the Company, but we would like to aid in setting up the sampling program.

H We also support alternative 4 from a fisheries standpoint and are strongly opposed to locating the tailings pond at the mine site. We also question the need for percolation ponds at the mine site. We would prefer to have all water collected and reused or slurried to the tailings pond.

Sincerely,

Roger Fliger
Roger Fliger
Regional Supervisor

CE:SM:dc

cc: Phil Jaquith
Bob Martinka
Charles Eustace
Steve McMullin

G The proposal would not change detectably the amount of sediment in the Stillwater River. The toe dam would capture sediment eroded off the tailings dam during operation. The company would maintain a diversion ditch at the base of the entire dam impoundment to collect runoff water during final reclamation. Water would be pumped to a sedimentation pond for clarification.

Monitoring suspended sediment in the river would be of little help in documenting changes caused by the mine because of the large seasonal and aerial variation in sediment transport in the Stillwater River. Total suspended solids would be monitored in any surface water discharges in accordance with Montana Department of Health and Environmental Sciences MPDES regulations.

The agencies will consider monitoring substrate sediments during preparation of the final water quality monitoring plan for the project.

H Comment noted; see response to comment A. The percolation ponds would have no significant hydrologic effects (see Chapter III--Hydrology).

LETTER #30

Kit Walther
Environmental Analysis Bureau
Dept. of State Lands

RECEIVED
JUN 1 8 1985
STATE LANDS

Dear Mr. Walther

Two features would make me far less dubious about the stability and safety of the settling pond and slurry system proposed in Stillwater Mining's Draft E.I.S for such extremely porous soil.

A 1. A backup system for both, using best available technology - in case of unforseen and unpredictable disaster - flood or earthquake, for example.

B 2. The hiring of top-notch Consultants by D.S.L. to review both planning & operation and structural soundness of the project. The river is the lifeblood of this unique area -

Very truly yours,
James G Milligan
Box 152, Rt 2 Nye, MT

A Comment noted, thank you. Please note the safety features and monitoring requirements for the tailings pond and slurry pipeline that are described in both chapter I, Preferred Alternative and chapter II, Alternatives 1 and 2.

B Comment noted, thank you. Please note the mitigating measures listed in chapter I, Preferred Alternative. The tailings impoundment design has been evaluated by specialists within and outside the agencies. Final design specifications will be similarly evaluated prior to construction of the impoundment.

STILLWATER
PROTECTIVE ASSOCIATION
Absarokee, Montana 59001

LETTER #31

June 17, 1985

RECEIVED
JUN 18 1985
STATE LANDS

Kit Walther
EIS Team Leader
Montana Department of State LAnds
Capitol Station
Helena, MT 59620

Dear Mr. Walther,

Enclosed are the comments of the Stillwater Protective Association on Stillwater Project Draft EIS. We appreciate the opportunity to comment on the plan.

We appreciate the more detailed analysis provided in this DEIS, compared to the earlier plan, and the consideration of a slurry line. The following comments are directed to particular areas of concern to SPA which we do not feel are adequately addressed in the DEIS.

If you have any questions concerning these comments, please let me know. Thank you for your careful consideration of these comments.

Sincerely,

Jack Heyneman

Jack Heyneman
President, SPA

LETTER #31

The Stillwater Protective Association offers the following comments on the Stillwater Project Draft EIS for consideration in the final EIS, so the agencies and the public can more fully evaluate the proposal and alternatives. We appreciate the time and effort the agencies have spent developing this draft, which offers better analyses than the previous DEIS, but feel there are still some areas which have not received the attention they deserve. Some of the concerns brought out at previous public hearings and meetings still have not been fully addressed.

A As the DEIS notes, the Stillwater Valley, surrounded by Forest Service and Wilderness land, is a unique and spectacular location characterized by "majestice peaks, deep canyons with narrow bottoms and sheer walls, high tundra plateaus, and swift, cold streams" (p. III-79). The Stillwater and West Fork of the Stillwater Rivers are a substantial fishery resource, ideal for spawning and rearing of game fish - brown trout, rainbow trout, brook trout, mountain whitefish. There is diverse and abundant wildlife, including elk, mule deer, white-tail deer, bighorn sheep, black bear, moose, and two endangered species, the bald eagle and peregrine falcon.

In short, it's a valley treasured for its magnificent fish, wildlife, and environmental values. The EIS must, although the DEIS does not, evaluate these qualities within the 'No Action' alternative. The contention that the Forest Service cannot deny a mining permit because the public lands are open to mineral location and entry is a distortion of NEPA, which requires consideration of the 'No Action' alternative. The EIS should look at the positive aspects of the 'No Action' alternative, as well as the impacts, instead of dismissing the agencies' ability to consider the option. This mandate has been upheld in various court decisions, most notably Environmental Defense Fund v. Corps of Engineers, NRDC v. Morton, and Calvert Cliffs' Coordinating Committee v. Atomic Energy Commission. At the least, the environmental and social values must be considered and protections implemented to protect these values of a very unique area.

B Economic Analysis

The economic analysis provided in the DEIS, often relied upon as rationale for dismissing alternatives, is a superficial presentation which does not provide reviewers with meaningful information on which to judge alternatives. For example, comments that backfill alternatives 'could' double project costs (p. I-9); that costs of mine portal alternatives could range 20-200% greater than proposal costs (p. I-12) are not sufficient bases on which to reject alternatives, particularly since no comparison is ever established between these costs and potential profits. The DEIS does not even weigh the benefits of the alternatives, but simply dismisses them.

C We understand the difficulty in providing precise cost estimates, but without better estimates, the present cost estimates should not be used as a valid reason for dismissing alternatives. Since the agencies are compelled to take environemntal values into account, protection of these values must also be considered. If the costs to protect these values preclude a profit, then perhaps the mine is not a viable venture, but the agencies' decision should not be based on whether the mine will make a profit, but on whether the best protections are used.

A Comment noted. Please see additions to Chapter I and Chapter IV, No-Action Alternative. However, note that Chapter III, The Existing Environment describes the conditions as they would be if the permit were denied.

B The cost estimates provided in the EIS are not intended to provide an economic analysis of the project alternatives. At the feasibility stage of project analysis, cost information is only preliminary and therefore variable. Only when a project nears construction will engineering specifications and costs be refined to a reasonable level of accuracy (± 10 percent). The EIS included the cost information that was used by the company in comparing project alternatives. The agencies used the cost information in the Stillwater DEIS because a large number of project alternatives was evaluated. The cost information helped in comparing the environmental benefits provided by an alternative to the cost of such benefits. In this regard, the agencies did weight the benefits of the alternatives.

The agencies do not determine the profitability of projects under consideration. The EIS reflects the environmental costs and benefits of project alternatives to the physical and human environment of the project study area.

C As noted in the previous answer, the agencies do not determine the profitability of a project. Chapter I explains the selection criteria. Cost alone is not a reason to dismiss an alternative.

LETTER #31

D SPA has particular concerns in the areas of hydrology, dam safety, and subsidence. The project may end in 30 years, but the tailings pond and mine stopes will be there forever, and protections must be provided to ensure the safety of residents and visitors throughout.

E Hydrology

Assumptions that the mine operations will not affect the groundwater of the Stillwater River (p. iv) or aquatic habitat (v); that specific impacts of a slurry spill are not known, although the effects would be temporary and most likely minor (vi); that the tailings pond would be a minimal hazard without the liner (IV-12); that there would be no effect on aquatic ecology (IV-29); and that no significant springs would be affected (IV-11) represent a superficial analysis of the potential problems with water quality. The DEIS already notes that Nye Creek, which cuts through old tailings, has chromium, iron and manganese levels above drinking standards, has low diversity of aquatic invertebrates, possibly indicating adverse effects of metals on the aquatic community (p. III-15) and that water near the percolation ponds exceeds drinking water criteria. You know the potential for damage, yet the DEIS does not seriously consider the impacts, nor does it anticipate requiring monitoring for aquatic invertebrates, nor requiring contingency plans for unanticipated leaks and spills from the tailings pond!

F It is difficult enough to understand why the agencies are willing to make such assumptions about a resource so vital to the livlihoods of residents in the area; it is even more difficult to understand why they are also unwilling to require monitoring and contingency plans when such plans could help avoid problems amounting to millions of dollars, and affecting the businesses, drinking water, fish and wildlife throughout the area. The EIS should consider requiring the plans, and if the plans are not required, explain why they are not.

G Dam Safety

SPA understands the agencies will require an underdrain system for the tailings pond at both the Hertzler and mine sites, and we support this requirement as a good first step towards helping to prevent dam failure. We still have concerns about tailings dam saturation, surface failures, and dam stabilization after abandonment. The smaller the pond, the lower the dam, and the better the infiltration control, the less is the chance for dam failure and damage.

H The DEIS notes the record for earthquakes over the last 30 years. We question whether 30 years is a long enough time to consider, and whether siting decisions should be made on such a short time frame.

I The report also states the piezometers will be reported regularly, and pond inspection reported daily. EIS should state how often 'regularly' means, and to whom the information is reported. It is critically important that the dam be monitored to ensure it is performing to design specifications.

J We also have concerns about the reclamation plans for the tailings pond and dam. Why is the dam going to have a 50% slope? State and federal laws impose limits on similar dam slopes of 20-30%. The steepness of this slope will certainly encourage erosion, make revegetation and

D Comment noted, thank you.

E The statements SPA cites are not assumptions. They are conclusions of the agencies' analysis of potential water quality problems identified in the scoping process of the EIS. The agencies acknowledge that the historic chromite tailings have caused pollution problems; however, the old abandoned chromite tailings are not comparable to the tailings that would be the product of SMC's proposed project. SMC's tailings would differ chemically. Metallic mineral concentrations would be low because SMC's milling operation would be very efficient. The tailings would have sufficient buffer capacity to neutralize acid production. Also, disposal of the talings would be controlled to prevent air quality problems and the tailings would be reclaimed after mining.

Because the agencies' analysis concludes that the proposed project would not impact the aquatic environment, Aquatic invertebrate monitoring is not necessary. The agencies, however, will give further consideration to this need before the water quality monitoring plan is finalized.

Note that in the final EIS, the preferred alternative requires the preparation of a spill contingency plan.

F See response to comment E.

G Comment noted, thank you. Note that the EIS agrees with your concern.

H Two separate lines of evidence indicate that the Beartooth Mountains and the Stillwater River Valley, in particular, have a low recurrence of earthquakes relative to more active areas such as Yellowstone Park. The 30-year record of reasonably accurate locations of earthquakes indicates the nearest active areas are probably over 40 miles away (the Emigrant Peak fault). The second body of evidence is the lack of recent offset along faults in the area (Camp Dresser and McKee, 1981). Based on these two lines of evidence, the occurrence of a large earthquake is very unlikely within the life of SMC's project and within 40 miles of the site. A large earthquake (7.0 magnitude) at this distance would produce a peak ground acceleration of about 20 percent of gravity. This conservative value was used to determine the safety margin of the tailings dam.

Using the modified Bishop method of failure analysis and the peak acceleration value of 20 percent gravity, the safety factor was determined to be 1.4 or 40 percent above the minimum conditions needed for mass failure of the dam face. For comparison, the Army Corp of Engineers generally requires an earthquake loading safety factor of 1.0 for large earthen dams.

I See Special Conditions listed in Chapter I.

J We are unaware of regulations limiting dam slopes to 20 to 30 percent. The steepness of the dam slope is limited by the physical properties of the dam material and by the reclamation technique. The 50 percent slope of the dam is not excessive in terms of stability (see response to comment H) or with regard to reclamation success (see Chapter IV--Geology Geomorphology for discussion of erosion rates and Vegetation for a discussion of revegetation success).

The company may choose to add waste rock to or revegetate the dam face at each stage of dam construction in order to minimize wind erosion. The company, however, might not protect the dam face because every 5 years or so they would then raise the dam covering the preexisting dam face in the process. Even if the dam face were unprotected, sediment eroded off the dam would be captured by the toe embankment surrounding the dam (see revised text Chapter II) and would therefore not affect the river water quality.

After mine closure, the impoundment would be dewatered and regraded to a dome shape to prevent water from collecting on the surface. The newly created slopes would not be sensitive to gullying. The revegetated surface and possible use of a waste rock cap would control gully erosion.

SMC originally proposed a spillway as part of the impoundment design because the company was of the opinion that regulations required spillways on all dams which is not the case. Spillways are not required for dams that have sufficient available freeboard to prevent overtopping. SMC's proposed impoundment would provide a sufficient freeboard. To illustrate the safety margin designed into SMC's impoundment we calculated the amount of runoff that would be generated by a 100-year, 24-hour event; the 240 acres of hillside draining into the impoundment and the impoundment itself would generate about 70 cfs. This amount of water would increase the impoundment water level by about 0.4 feet during the final stage. The impoundment would have an available freeboard of 7 feet at this stage, which is over 15 times the increase generated by the 100-year event. In fact, SMC's impoundment would be designed to retain half the probable maximum flood (PMF) during the first three stages of development and the entire PMF during the last two stages. The reason SMC is able to have such a large safety factor with only 7 feet of freeboard is because the drainage area located above the proposed impoundment is small.

J reclamation more difficult, and encourage gullying. DEIS does not explain why a mound for final contouring is being proposed, although that may certainly create gullying. According to the DEIS, the dam will be unvegetated during dam construction...which is scheduled to go on for almost the entire life of the operation. Why isn't the dam going to be revegetated during operations, to help avoid the heavy erosion rates of 60 tons per acre (p. IV-6)? We suggest hydromulching be required to control erosion. Finally, why is a spillway not included in the dam design? It was originally included in plans by Stillwater Mining Co.'s engineers, but not committed to in its application. The DEIS states simply that the dam may include a bedrock spillway. The EIS should require the spillway, or explain why one is not needed. How much freeboard will be available to prevent overtopping permanently (p. II-13)?

K According to the DEIS, the pond will be covered with water at all times (II-13, IV-45). There is no discussion of how this will be maintained during, for example, temporary closures, or low water. It's a nice assurance, but we have already seen at the Asarco Troy project that it may not be so easy to achieve. What is the potential for problems from the wind on the surface of the tailings pond, with and without water? Many residents testified at the public hearing that the data in the DEIS on wind speeds greatly understated the wind speeds in the area. We trust the agencies will have the more accurate data for the EIS, and will also, in light of the new information, consider the effects of the wind on the pond water, and on the tailings emptying from the spigots into the dam. The 100-hr. winds could create severe problems in areas where wind is normally not a concern.

L The DEIS states the slurry line will be buried, and will be two pipes. At one point, it states the line will be dual-walled across the West Fork, with catchment basins (II-20); elsewhere, it states the line will be two walls (IV-30) and that collection ponds may be used (IV-13). EIS should make it clear whether the entire line will be dual-walled, and whether catchment basins will be required. SPA sugggests both, since the potential damage from a slurry spill could be critical. We also have concerns about the pipe itself, its ability to withstand corrosion, and plans for periodic review of the pipe, which is not mentioned in the DEIS. Will the pipe be plastic coated? Also, there seems to be some confusion yet about the length of the slurry line to serve the Hertzler site. Pages v, I-5 mention a 7-mile line; pages IV-20, IV-28, and IV-42 mention a 6-mile line; and pages I-4 and II-20 mention a 7-9 mile line.

M We support the idea of a slurry line to the Hertzler pond site; it avoids the traffic impacts SPA so vehemently opposed in the 1982 DEIS, and considers an option that was never considered earlier.

N Subsidence

On page I-19, the DEIS notes the public had major concerns about problems with subsidence. Yet, on page VI-15, the DEIS claims because the mine area is relatively remote and little used for recreation, the danger posed by subsidence is low! Considering that the mine stopes

K SMC would be required to control wind erosion and dust during temporary closures and through the period until the reclamation of the tailings pond is determined complete and the reclamation bond is released by the agencies. The company would have no problems controlling dust from the tailings pond. The Stillwater Mine would not experience the same problems as ASARCO Troy because tailings would be deposited in an aqueous state rather than sub-aerially--forming a beach of sands that are subject to blowing.

Wind speeds in excess of 75 miles per hour are classified as hurricane force (Critchfield, 1974). Wind speeds of 100 miles per hour would be extremely destructive. Human perception of wind speed is often inaccurate. Although gusts of 75 mph may occur, it is highly unlikely that such speeds are sustained; one year of monitoring did not record an hourly wind speed greater than about 35 miles per hour.

L Cost estimates and engineering for the slurry line are based on a conceptual level of design. The initial design parameters for purposes of estimating costs included: buried pipeline in a 5-foot-deep trench in road right-of-way, both the slurry and water return pipeline sleeved in a larger diameter pipe at the West Fork of the Stillwater River crossings (dual-walled pipeline), excavated spill catchment basins on each side of the river, extra heavy welded pipe, coated and wrapped to resist wear and corrosion, approximate length between 7 and 9 miles, and instrumentation to measure pipeline pressures to detect leaks.

The inconsistencies you have noted have been corrected. The slurry pipeline would be between 7 and 9 miles in length.

M Comment noted, thank you.

N The agencies gave a great deal of consideration to subsidence and the need for backfilling the mine stopes to minimize subsidence. The hazard to human safety and welfare caused by crown pillar collapse would be low. Effects of collapse would not be visible for hundreds to thousands of years after mining, if that. The only means of preventing crown pillar collapse would be to backfill the empty stopes. Backfilling the empty stopes with all of the coarse fraction tailings would double the cost of

N will remain forever, that the area is riddled with fractures and old mine developments, that Appendix C has already identified some of the very severe possibilities of subsidence, it is hard to understand why the backfill options were not given more consideration. We suggest these options should be given more attention, and a much better explanation of why they are not required, if that decision is made.

O Because of the major potential problems with hydrology and geology at the mine site, no possibility for pond expansion, the effect of the mine site pond location on recreationists and local dude ranchers and outfitters, and aesthetics, and the advantages of a smaller pond, lower dam, SPA supports alternative 6, placing the pond at the Hertzler site, with backfilling. The reasons for elimination of the backfill alternative (superficial cost estimates) are not sufficient in the DEIS, and deserve further consideration.

Other Concerns

P There is no discussion of the market for the minerals, the currently depressed minerals prices, and its effect on the mine proposal, or the possibility of temporary or prolonged mine shutdowns because of mineral prices. The Stillwater Mining Co. application states that the actual life of the mine would be determined by its economic viability, which is a function of metal prices, grade and continuity of ore zones, and costs of production. Why, then, is there no discussion of the possibility of a temporary or premature shutdown, which is certainly a possibility, considering the current market and this is now problem with other mine projects in the state? What mitigation measures is SMC prepared to take? These are also possibilities that should be discussed under the 'No Action' alternative.

Q Contingency Plans

The emergency and contingency plans should be also sent to the local fire/sheriff's departments. These plans often have the habit of being forgotten or ignored, and it is advisable to have someone else with the plans who may be responsible for responding to an emergencies. Will these plans be reviewed periodically to ensure they are up-to-date?

R Why is busing still not required, or even analyzed in any detail, when the benefits of a busing system have been supported over and over again by so many affected by the project? The DEIS notes the well above average accident rate for FAS 419, and the advantages of a bus system, but no explanation is given of why it has not been required.

S Alternative 5

It is very discouraging to see the agencies support alternative 5, sayng that traffic under the proposal would not be a significant hazard. SPA vehemently opposed the Anaconda proposal to truck ore between the mine site and the tailings pond site because of the danger to residents and recreationists, stock, and wildlife. We still very much disagree with your contention that 100 trucks a day, running 24 hours a day, 7 days a week along a county road is not a hazard. This presents a significant hazard, and a tremendous nuisance to travellers using the same road. The EIS should more seriously evaluate this support.

mining in most cases. The added cost does not justify the small gain in environmental benefits after all things are considered. Please note that the company has revised its mine plan and will use cut-and-fill methods to mine the platinum-palladium ore body. The change was made, however, for reasons other than environmental considerations. Also note that the preferred alternative includes a mitigating measure to enhance crown pillar stability (see Preface and Chapter I, Preferred Alternative 1).

O Comment noted, thank you.

P Discussion of the minerals market and its effects on the applicant's proposal is speculative and outside the scope of the EIS. The EIS does discuss the consequences of temporary and prolonged mine closure (see Sociology, Community Services, and Fiscal Conditions). The company would be required to implement the following procedures during a temporary shut down of the mine:

- --Close all unused portals to public access either by backfilling or by construction of sturdy adit entrance barriers.
- --Temporarily revegetate areas where wind or water erosion is determined as a problem.
- --Meet all air and water quality laws (for example, maintenance of percolation ponds).
- --Pay unemployment insurance benefits for laid-off workers.

Should the mine shut down permanently, the company would be required to fully decommission the mine and facilities (that is, remove all structures and permanently reclaim all disturbances). The only significant difference between the permanent closure and an early shutdown would be the loss of projected revenues the county and state would receive, the early layoff of mine workers, and the need for total reclamation of all disturbances.

Q Comment noted, thank you. The contingency plans would be made available to local officials. The plans would be updated whenever new information warranted revision.

R SMC will implement a traffic reduction plan for FAS 419. See preferred alternative, chapter I (mitigating measure M).

S Comment noted, thank you. The agencies feel the analysis is correct. The agencies did not consider the number of ore trucks travelling between the mine and mill site under alternative 5 to be a significant hazard

LETTER #31

T What are the plans for game monitoring? Considering the unique wildlife diversity present in the complex, some sort of wildlife monitoring is in order. Without it, there is no way to know how the mine operations are affecting the wildlife, and take measures to alter negative impacts.

U Page I-9, backfill alternatives: should be 1, 3 and 6.

V Page I-11 shows 10 portals, not 11.

W There are no maps showing locations of alternative tailings pond proposals that show exactly how close to the rivers the ponds would be. These should be included in the EIS.

X Reclamation

The DEIS does not explain why planting and seeding rates below those recommended are being allowed, or why recommended seeding and planting rates cannot be required.

Y Page IV-24 states that if noxious weeds begin to invade any specific reclamation area, SMC will eradicate the weeds.This should be any disturbed area.

Z The DEIS does not provide an honest discussion of the impacts on the community of a temporary or prolonged unexpected mine shutdown. If the agencies are so willing to dismiss these impacts, perhaps they should visit a town hit by mining layoffs, such as Butte or Anaconda. This project is a smaller scale, but the effects are still there.

AA There is also no discussion of the impacts of a large influx of people on the housing prices. The DEIS notes that senior citizens make up 31% of the county's residents, yet says simply that housing prices could increase initially, and does not introduce the probability that this could be a problem for the county's poor or senior citizens living on a fixed income. It deserves more discussion in the EIS.

BB West Fork Access Alternative

Although the agencies have chosen the new access route to the West Fork of the Stillwater as their preferred alternative, the discussion on the alternative is so riddled with contradictions that we wonder if this was'nt perhaps a poorly thought-out concession to the NEPA requirements for alternatives.

Page x states that acquiring the private access necessary for the new route could be difficult (also on page V-8). Page I-17 notes the cost of the alternative at $100,000 - 150,000 plus land acquisition costs; the same page also states the benefits of the alternative would be achieved at a cost of $150,000 - 200,000. Does this mean land acquisition costs could range from $50,000 - 100,000? Page II-25 estimates right-of-way acquisition at $10,000 of a $150,000 price tag for the alternative.

We understand that the landowners are not willing to sell the land for access, although the agencies apparently never bothered to talk to the landowners before choosing this as a preferred alternative. How then, could they have had any idea what the land acquisition

because the trucks would use only seven miles of the road. In addition, much of the distance is along FAS 420, which has less traffic than FAS 419. Posting warning signs before and along the ore truck route would help reduce the potential for accidents.

The agencies realize that ore transport under alternative 5 would constitute a public nuisance. Although public safety under alternative 5 would be endangered more than under other alternatives, the potential threat was considered to be moderately significant. Note, however, that because of the company's plans to mine by cut-and-fill stoping that alternative 5 is no longer feasible and has been deleted in the final EIS (see Preface).

T The preferred alternative requires the applicant to submit a bighorn sheep monitoring plan (see chapter I).

U You are correct, but the reason for dismissing alternative 3 was discussed in the previous paragraph on page I-9.

V You are correct. The figure has been corrected.

W Figure I-1 illustrates the location of the proposed tailings pond and alternative tailings ponds relative to the Stillwater River. Distances of each have been added to the discussion of tailings ponds in Chapter II.

X The preferred alternative would require SMC to increase seeding rates when seeding portions of disturbed lands over 5,300 feet (see Chapter I). Although the postmining densities of weedy plants would be lower than premining densities, adequate wildlife cover and browse would still be provided; therefore, no change in shrub and tree planting is necessary.

Y SMC would be required to control weeds on all areas within the permit area. See revised text.

Z The agencies did not dismiss the impacts of a mine closure (see pages IV-47, IV-49, IV-54, and IV-59 of the DEIS). It is difficult to predict the exact impact of mine closure. The discussion is general because the effects can vary. Many of the impacts of a mine closure depend on the availability of other jobs to unemployed miners.

Stillwater County would not experience the same impacts from a temporary or permanent mine shutdown as Butte or Anaconda have with the closure of the Anaconda copper mining and smelting operations. As you note, the SMC project is much smaller than the Anaconda operation. It would comprise a smaller proportion of total county employment than did the Anaconda operation in Silver Bow County. Furthermore, employment opportunities for unemployed SMC workers would be enhanced due to the proximity of Billings, which is within commuting distance of Columbus and Absarokee. The SMC permanent shutdown is scheduled in 30 years unless additional ore reserved are delineated. People could plan for such an eventuality, unlike Anaconda employees in Silver Bow County.

AA If the company builds the newly proposed worker camp, housing prices should remain relatively stable, unless the camp creates a surplus of housing units. In that case, the rental values of temporary housing may fall and if the supply is especially large relative to the demand, prices of houses for sale could also be depressed.

If the company does not build the worker camp, the situation described in the DEIS would be more likely. There is a discussion of possible impacts to housing prices on p. IV-52 of the DEIS. Please note that housing prices could rise initially and then decline if the company were to hire mine crews in the final quarters of construction activity. In that scenario, people who owned homes would not be affected by housing price increases unless the appraised value of their homes was changed. However, the duration of the housing price spike may not last long enough to warrant a re-appraisal of property. Persons who rent houses may not be affected by housing cost increases unless they choose to move into a new residence. In all likelihood, some people who are either poor or elderly could be affected by higher housing prices, but not all would be.

BB The comment that the West Fork Road alternative is "riddled with contradictions" is overstated. The contradiction in estimated cost has been corrected in the text.

Cost of acquiring the land is an estimate of the fair market value of the land not that of the landowners' selling price. The agencies are aware of the landowners' unwillingness to sell; however, this fact does not preclude the agencies' obligation to examine the alternative. The West Fork Road alternative affords clear advantages to the company's proposal.

costs might be to make a preferred determination?

LETTER #31

CC Power Line

Page I-13 notes the current 50kv line cannot handle mine operations. Elsewhere, the DEIS says the mine will eventually require more power, so it goes on to explain the various alternatives and the alternatives within the preferred alternative that Montana Power Co. is looking at.

First of all, there is no economic analysis of the alternatives, so eliminating the option to convert the 69kv line because it is more costly is not an analysis of alternatives. Neither is the elimination of a new 100kv line as an alternative a valid decision, based on the fact that it will not meet future needs, since there is no discussion anywhere of the problems with the current supply, the needs of the mine itself, now and in the future, or of the 'future needs' the DEIS says must be considered.

In fact, we understand the powerline now may not go in as soon as planned. This sudden change indicates that not all the facts were considered in the DEIS, otherwise the no action alternative for the powerlines would have received more discussion. It now is the way the company wants to go, at least for the present.

The powerline discussion also did not address how changes in the power supply would protect existing users. Many of our members have indicated there were problems with power surges during previous mining efforts, and would like assurances that this will not happen if the new mine operates.

CC The Stillwater 50-kV power line is currently at capacity. Unacceptable voltage levels (exceeding MPC's voltage fluctuation criteria) would occur at the mines projected full load (MPC, 1984). During certain peak-load periods, even when the mine is operating at less than full load, unacceptable voltage levels would occur. Because Montana Power Company (MPC) would not hook up a new load that would adversely impact its customers (Gene Braun, MPC, September 14, 1985), SMC would have to commit to mitigating measures (such as reduce on-site electrical consumption or provide supplemental on-site electrical generation during critical peak periods) to ensure existing customers are not impacted.

LETTER #32

Billings, Montana
June 17, 1985

RECEIVED
JUN 1 8 1985
STATE LANDS

Environmental Analysis Bureau
Montana Dept. of State Lands
Capitol Station
Helena, MT. 59620

Attention: Mr. Kit Walther

Gentlemen:

Our Billings Rod and Gun Club and Southeastern Sportsman Association, representing 9 clubs and 5,000 Montana sportsmen, are concerned about the impact the Stillwater Mining Company's proposed project would have on fish and wildlife and related recreational resources. We do not oppose progress as long as it is done in a reasonable manner to protect Montana's important living natural resources from short-term and long-term degradation and provides adequate mitigation for unavoidable natural resource damages.

We concur in the June 12, 1985 comments provided to you by Roger Fliger of the Montana Department of Fish, Wildlife and Parks. However, we emphasize the following points.

A Public access across private property to the Forest Service boundary is a problem in this area now and will be more of a problem as the human population increases with project development. Therefore, the Company should be required to provide perpetual public access to the forest boundary at the Benbow Mine area, Picketpen, Beartooth Ranch, and at other sites considered necessary by the MDFWP. The Company should be required to purchase sufficient land, or to obtain permanent easements, and construct roads as a project cost as necessary to accomplish this objective to the satisfaction of the MDFWP. The MDFWP should specify the exact location and management of these roads in cooperation with the Forest Service to control public use to protect wintering wildlife from harassment.

B In addition to the project sponsored studies and work recommended by MDFWP, we believe that the Company should fund at least one-half of the annual cost of a MDFWP Game Warden to protect the area from anticipated people caused fish and wildlife problems that will increase with the project.

C Copper sulfate and other chemicals used in the milling process and that would seep from the mine adits would cause damage to aquatic life. Therefore, none of the potentially damaging chemicals should be allowed to enter surface or ground waters in the area.

We appreciate the opportunity to comment on this project.

Sincerely yours,

Paul F. Berg

Paul F. Berg, Legislative Committees
Billings Rod and Gun Club, and
Southeastern Sportsman Assoc.
3708 Harry Cooper Place
Billings, Montana 59106

A The EIS predicts increased pressures on the Forest Service and landowners to provide more access. Closures of existing access routes are not anticipated. Letter 29 from the Department of Fish, Wildlife and Parks does not mention new access points.

B An additional game warden would be of questionable value. Another warden could not reduce the impact of increased numbers of people legally hunting and fishing. The magnitude of poaching and wildlife harassment cannot be predicted with any reasonable degree of certainty. Also, the effectiveness of a warden in reducing illegal activity is unknown.

C The tailings liquid would have an estimated copper concentration of 0.05 ppm (Appendix D). The maximum tailings liquid seeping to the ground water from both the tailings pond and percolation ponds would be about 50 gpm. The increase in concentration of copper in the Stillwater River at the minesite (0.06 ppb) would not be harmful to fish nor aquatic life. Copper concentrations naturally range from 2 ppb to 17 ppb in the Stillwater River.

LETTER #33

COUNTY OF STILLWATER
STATE OF MONTANA

June 17, 1985

COLUMBUS,MONTANA

RECEIVED
JUN 1 8 1985
STATE LANDS

Mr. Kit Walther
EIS Team Leader
Montana Dept. of State Lands
1625 11th Avenue
Helena, Montana 59620

Dear Mr. Walther:

Enclosed please find our written comments on the draft Environmental Impact Statement for the Stillwater Mining Company Stillwater Project. These comments are submitted as part of the record and for your use in preparing the final Environmental Impact Statement.

Sincerely,
BOARD OF COUNTY COMMISSIONERS

Ezra G Reckman
Chairman

Robert H Story Sr.
Member

Earl K Adams
Member

LETTER #33

We are pleased with the work the U.S. Forest Service and Montana Dept. of State Lands have done on the Draft EIS. This draft is a noticable improvement over the previous draft EIS for Anaconda Minerals Company. We would like to thank the entire EIS Team and especially your economist and the U.S.F.S. District Ranger for cooperating with local government officials to eliminate duplication of effort in data collection. This cooperation has resulted in improved quality of both the draft EIS and Hard Rock Mining Economic Impact Plan documents.

We only have a few comments to offer on the Draft EIS. **Please consider the** following comments when preparing the final EIS.

A 1. In the summary section and again in Section IV on Fiscal Conditions there appears to be some confusion in the use of the terms assessed value, property tax, and taxable value. These terms do not always have the same meaning, especially for mines. The assessed value is currently a percentage of the market value. The taxable value is a percentage of the assessed value depending on the classification of the property. The property tax is the taxable value times the mill levy.

B 2. In the introduction under the Agency Responsibilities section, the affected units of local government in Stillwater County have the responsibility to review the Impact Plan not the Hard-Rock Mining Impact Board. This board only checks the plans for technical compliance and acts in disputes between the mineral developer and local governments.

C 3. The No Action alternative deserves more attention and should be compared with the other alternatives.

D 4. The Land Use Sections in both chapter III and Chapter IV did not include a description of commercial land uses in the surrounding area or an evaluation of the potential impacts to commercial enterprises. Please be advised that Stillwater County does not have a Master Plan or Zoning with the exception of the Town of Columbus and the West Fork of the Stillwater River. Therefore, the County has no authority over land use conflicts in the area of the proposed mine.

E 5. In the Transportation Section, please note on page III-78 that Federal Aid Secondary 420 also has approximately 7 miles of pavement.

F The transportation impacts unique to Alternative 5 are unacceptable to Stillwater County. As many as 100 trucks and additional work related traffic would inconvenience existing users, increase noise and dust levels, and increase the likelihood of accidents on a road which is already above the state average in number and severity of accidents. In addition the roads and bridges in this area were severely damaged as a result of the chrome hauling and would be heavily impacted if ore is trucked to the Hertzler Vally under Alternative 5.

G We also recommend that the Mitigating Measures for impacts to the transportation system require a Memorandum of Understanding among Montana Department of Highways, Stillwater County, and Stillwater mining Company to record the agreements, duties, and obligations of each (see attached example).

Thank You for considering our comments.

A Thank you for your comment. The wording has been changed to avoid confusion.

B A change was made in the text to correct this error.

C A discussion of the no-action alternative has been added in the final EIS (see Chapter I and Chapter IV).

D The land use section does not describe commercial enterprises because such businesses are included in the employment and income sections of the EIS. In those sections, effects of the project are described at a county-wide level. Specific enterprises or industries are seldom analyzed separately because industry-level data is generally not available. However, if an industry is crucial to or the major employer in a county economy, it will be discussed separately, as was agriculture.

The land use section identifies major land uses in the area--agriculture and recreation. The section also discusses the trends for these uses. As in the income and employment sections, only major dominant uses are discussed.

E Comment noted, thank you. See Chapter III, Transportation.

F Comment noted, thank you. See response Q, letter 31.

G Comment noted, thank you. Please see chapter I, Mitigating Measures of the Preferred Alternative.

LETTER #34

DEPARTMENT OF NATURAL RESOURCES
AND CONSERVATION

TED SCHWINDEN, GOVERNOR
32 SOUTH EWING
STATE OF MONTANA
(406) 444-6699
HELENA, MONTANA 59620

June 18, 1985

Mr. Kit Walther, Chief
Environmental Analysis Bureau
Reclamation Division
Montana Department of State Lands
Capitol Station
Helena, MT 59620

Dear Mr. Walther:

The Montana Department of Natural Resources and Conservation (DNRC) has reviewed the draft environmental impact statement (EIS) on the Stillwater Project and offer the following comments.

A 1. The "Agency Responsibilities" section of the Introduction should include an explanation of DNRC's permitting and regulatory authority under the Montana Water Use Act and the Montana Major Facility Siting Act (MFSA).

B 2. With regard to water rights, it appears that Stillwater Mining Company will need to obtain a provisional permit from DNRC before using water for the mining/milling process, dust control, and slurry line. For the drinking water, it will probably be sufficient for the company to file a notice with DNRC, after completion of the wells, in order to receive a Certificate of Water Right. To obtain the appropriate water use authorizations and avoid affecting holders of existing water rights in the area, the company should work with Keith Kerbel of our Water Rights Field Office in Billings.

A Comment noted, thank you. See final EIS.

B Your letter explaining DNRC's water rights procedures has been sent to SMC. SMC already has received a water right appropriation from DNRC for the well serving the exploration development and office buildings. Mill process and mine development water would come from this well and from the ground water discharging from the mine workings. The only new water source that is currently envisioned is a small production well to supply potable water needs. SMC, in a letter to DSL, acknowledged the need to obtain water rights for the mine drainage water as well as for the potable water well for operations. It is the company's responsibility to obtain these approvals from DNRC.

C 3. With regard to power, the descriptions of the alternatives and the process DNRC will follow are generally accurate. The discussion of impacts could mention that the existence of a transmission line on cultivated land may increase the time and costs of cultivation. However, no conclusions should be drawn regarding either impacts or a preferred route until the required MFSA evaluations are complete.

Thank you for the opportunity to review the EIS. Your office and the U.S. Forest Service are to be commended for the effort that has gone into this document.

Sincerely,

Larry Fasbender
LARRY FASBENDER
DIRECTOR

cc: Laurence Siroky
Gary Fritz
Carole Massman

C Comment noted, thank you.

LETTER #35

Gat Walther, chief
Environmental Analysis Bureau
Mont. Dept. of State Lands

RECEIVED
JUN 19 1985
STATE LANDS

Dear Sirs.

Please consider the following statements as our testimony concerning the Draft Environmental Impact Statement for Stillwater Mining Company's mine proposal.

A We feel that Alternative #6 is the most acceptable production system. Your cost estimates, though, are not at all clear as to why there is a large cost difference between alternatives #4 and #6. Considering the total profits from the project (2oz/ton x 1,000 ton/day x 30 yrs x $\$265^{00}$/oz) of 5.66 Billion, a million dollars here and there is a small price for the environment of such high quality as the Stillwater River valley. Without more information on the slurry line design, we are reluctant to support this system. The advantages of having the settling ponds at the Hertzler site have been well addressed in the DEIS, but several things should be considered to make this system more environmentally sound. The pond should be lined with hypalon to prevent leaching of mine effluent and heavy metals into the ground

A The cost difference between alternatives 4 and 6 as they were presented in the DEIS is due to a difference in tailings disposal methods. Alternative 6 would require the company to backfill or place part of the coarse sand fraction of tailings into the empty mine stopes. This procedure is more costly than putting all the tailings into an impoundment.

The profit calculation of $5.66 billion is erroneous. Please refer to tables VI-10 and IV-61 for an estimate of gross annual income for the project at current metal prices. The expected ore-producing life of the mine is only 25 years; therefore, over the 30-year operation, total gross income would be $580 million, not $5.66 billion. Net income or profit, after production expenses, debt service, and taxes have been subtracted from gross income, has not been estimated.

Lining of the pond at Hertzler Valley would not be necessary based on the hydrogeologic assessment performed on Anaconda Minerals Company's original Hertzler Valley impoundment. A clay cap would not be necessary because after reclamation the amount of deep percolation through the tailings would be small.

Note that alternative 4 has been deleted in the final EIS (see Preface). Also, alternative 6 has been changed to alternative 2 in the final EIS (see Chapters I, II and IV).

water, and when it is reclaimed, it should be crowned and capped with 4" clay layer to prevent normal precipitation from causing further damages.

B Many residents of the area have commented at the public hearings that your wind speed data does not represent the normal wind speeds that occur in the area! Personal readings from a neighbor's wind gauge showed maximum wind speeds of 75 mph and 70 mph in a two week period in January of 1985. This apparatus is on a house in the river bottom located down-wind from a large ~~[illegible]~~ grove of trees. The actual wind speed out in an open area such as the mine site, would be substantially higher. The American Chrome Co. manned a weather station at the mine site all of the time it was operating, and you should get this information and modify your data. It is your responsibility as public representatives to collect the best data possible and to act responsibly to public comment. Greater wind speeds (almost double) could severely hinder reclamation attempts as was the case with the old tailings pond site.

C On page III-70, it states, "Nye

B The wind speed data were collected for a one-year period at the minesite at a station located on the reclaimed chrome tailings . The data are presented as hourly averages. As the EIS states on p. III-57, "During January 11-12, 1981 the speed at the minesite exceeded 29 mph for 29 consecutive hours." The high-volume air sampler was also located on the reclaimed chrome tailings. If the "poor" reclamation had resulted in sizeable exposed areas, one would expect high TSP concentrations to be recorded. This was not the case; TSP concentrations were low.

Records of wind speeds are not obtainable from the American Chrome Company, because the company no longer exists.

C The final hard-rock impact mitigation plan written and adopted by Stillwater County and Stillwater Mining Company identifies a baseline enrollment for Nye elementary of 7 students with an estimated mine-impact

C elementary school ~~stu~~ enrollment has ranged from 8-17 students over the past six years. The current enrollment is 8 students; The lowest enrollment in 6 years. "The school has one teacher and one classroom with capacity for additional students." It goes on to say on III-59, "Seven additional students are projected to enroll in the Nye elementary school... Both schools have adequate capacity to absorb the increased enrollments." It is our understanding that in a one teacher - one classroom situation, such as Nye, with multiple grades (K-8), that the maximum number of students for Mont. School Accreditation Standards is 18 students. Your projections are for 15-24 students. Considering a potential overcrowding in the Absarokee Elementary School, some students in the Nye area currently attending Absarokee, may choose to return to Nye school, thus we cannot accept your opinion that the school has "... adequate capacity to absorb the increased enrollments." Either you were not aware of the multiple grade standards or you are not considering the present potential for students in the Nye area.

D In section III-11, it states that the

enrollment of 8 to 10 students for a total enrollment of 15 to 17 (p. 86). Such enrollments are within accreditation standards. The conclusion of the impact plan is that the Nye school has adequate capacity to absorb new students. The impact plan was reviewed extensively by county and school district officials and was approved. In addition, the plan can be amended if more than 10 mine-related students enroll in the Nye elementary school (p. 95). The FEIS has been changed to reflect assumptions approved in the final impact plan.

D The spring monitoring data would be sent to the Montana Department of State Lands and the U.S. Forest Service. Should it be determined that the company has adversely affected an offsite water supply, it would be required to take remedial action or replace the supply.

Forest Service would require SMC to monitor certain springs that could be potentially affected. It should also require that this information is filed with the Forest Service along with data that Anaconda Co. has collected from these springs in the past 6 years. This section should also include mention of replacement of damaged water supplies as set forth by the 1985 Metal Mines Reclamation Act.

E The discussion of noxious weeds on II-24 implies that the company would only be responsible on "reclamation areas". The major problems would most likely occur in areas that aren't reclaimed such as roads & portal entrance sites. Many of these areas are on Forest property, and it should not be lift up to the Forest Service to control weeds on areas that were disturbed by post mining activities as is the cas now.

F In closing, we would like to support the comments which you have received from Douglas Scott from the Institute of Natural Resources. For the sake of brevity and repitition be it sufficient to say that we

E SMC would be required to control noxious weeds within the entire area permitted by the agencies. The text has been revised.

F Comment noted, thank you. See responses to letter 41.

LETTER #35

feel they should be taken seriously.

Thank-you.

Sincerely,

Noel & Penny Keogh

2016 Interlachen Dr.
Billings, Mont 59105

LETTER #36

Kit Walther
Dept of State Lands
Capitol Station
Helena, Montana 59620

RECEIVED
JUN 1 8 1985
STATE LANDS

Dear Sir:

I'm sorry to be getting my opinion into you just under the wire. I've been in the Hospital for surgery and just wasn't able to get to it before now.

I feel very strongly against the proposed mining in the Absorokee Nye area by the Stillwater Mining Company.

I don't feel it would benifit us locally all that much. the impact on that fantasically beautiful area is unthinkable. We have no right to damage such natural beauty in any way.

Our family camps at Woodbine Campground every weekend that we can. We, as well as most everyone that goes there for recreation or lives in the area, are carefull not to disturb or polute the

Comment noted, thank you.

LETTER #36

environment.

I'm sure the proposed mine would change the character of the small towns of Columbus, Absarokee, and Nye. It would be a burden on their school and police departments and I really don't think the roads can handle it.

Please don't approve a mining permit.

Sincerely –

Marilee & Ron Harakee

LETTER #37

RECEIVED
JUN 2 0 1985
STATE LANDS

0130 S.W. Thomas
Portland, Oregon 97201
June 17, 1985

Kit Walther
Department of State Lands
Capitol Station
Helena, Montana 59620

Dear Mr. Walther:

Attached please find my comments on the draft environmental impact statement (EIS) for the Stillwater Project.

These comments are directed primarily at the agencies' preferred alternative for providing access to the West Fork of the Stillwater River Trailhead. They are divided into three sections: criteria used in assessing the proposed alternative, legal abandonment of the proposed road and the applicability of Montana's Eminent Domain Statute, M.C.A. 70-30-101.

I support the comments that were submitted by the Stillwater Protective Association pertaining to technical problems in the EIS.

Please place me on the department's mailing list so that I may receive all documents pertaining to the Stillwater Project.

Thank you.

Sincerely,

Torian Donohoe

Torian Donohoe

attachment

c.c. Phillip Jacquith

LETTER #37

As one of the landowners' whose property the proposed access road would cross I am strongly opposed to this alternative. Every legal and administrative avenue will be exhausted to insure that this alternative is not realized.

Criteria Used In Assessing the Proposed Alternative

The criteria used by the agencies in determining that the Picket Pin Creek Road provided a superior alternative is unrealistic.

Visual If a mine and mill complex is going to be constructed in the Stillwater Valley this fact cannot be hidden from the public. There is no reason to insulate the public from the mining operation if the agencies consider it to be a valid multiple use. Public scrutiny will help facilitate an environmentally sound operation.

The Stillwater Mining Company (SMC) should welcome the opportunity to publicly demonstrate its ability to operate a mining and milling operation while preserving the environment in an important recreational area. The visual impact of SMC's operation should be minimal since it is relatively limited in size.

Transportation and Public Safety

On page I-17 the EIS states that the alternative route will result in "no inconvenience or delays to public accessing West Fork of Stillwater". The alternative route would require the public to travel a longer distance to reach the trailhead than the existing road does. The alternative would require the public to travel over approximately ten miles of narrow gravel road. The county road leading to the Picket Pin Creek Road is

A When compared to existing conditions, the mining operation would significantly change the visual resources at the minesite even though the operation, as you have suggested, would be "relatively limited in size."

Neither the mitigating measures nor the road access alternative discussed in the EIS would "insulate" the public from the mine operation. Rather, these options would reduce the visual impact of the mine. As you have mentioned, the mine cannot be hidden from view. The minesite would be visible from FAS 419 and surrounding locations.

B The EIS states that routing traffic over the Picket Pin Creek Road would eliminate inconvenience, delays, and potential danger to the traveling public caused by mining. Such advantages seem to outweigh the disadvantage of the minor additional mileage for recreational travelers using the Picket Pin Road to access the trailhead.

The EIS notes that the Picket Pin Road would increase maintenance costs for Stillwater County.

It is true that SMC could schedule blasting and other activities to coincide with nonpeak travel times. However, routing the public through a working mine still poses potential safety problems to travelers and presents a daily management and coordination problem to mine personnel.

LETTER #37

already heavily traveled in the summer and fall by recreationists and exploration crews working on Iron Mountain. The preferred alternative would result in increased road maintenance costs for Stillwater County.

Potential traffic delays and public safety problems could be minimized by SMC scheduling blasting and other work activities that might result in delays or safety hazards for non-peak travel periods Public safety can be realized without constructing a new road and bridge. SMC has adequate opportunity, thirty miles from Absarokee, to post signs advising the public to proceed with caution before entering the mining area. Furthermore, SMC could operate an information booth in the Fishtail or Dean area and if there was a lengthy traffic delay at the minesite recreational traffic could be re-routed to Mystic Lake, the Rosebud or Iron Mountain.

C Wildlife

There will be a greater effect on wildlife and fishery resources that the EIS reflects if the Picket Pin Creek Road alternative is constructed. Recreational traffic that previously went to Iron Mountain will be likely to re-route to the West Fork if provided with a simple alternative. Since the currently existing road would still be open to SMC personnel and their families there will be increased human impact on the West Fork with the construction of the alternative road. This impact could have an adverse impact on the elk herd. Presently the herd can go on private property which is accessible by public road on only one side. If the road is constructed the private property where the herd ranges will be accessible

Rerouting traffic to Mystic Lake, the Rosebud, or Iron Mountain when it would not be possible to use the Picket Pin Creek Road would have even more serious disadvantages than the Picket Pin alternative. Travel time over poor roads would be increased substantially, and county road maintenance costs could be increased.

C The impacts of the Picket Pin Road alternative on elk are discussed in Chapter V. This alternative would close FR 846 (see figure I-4) which would force everyone (including SMC personnel) to access the West Fork via the Picket Pin Road. Regardless of the road alternative chosen, increased fishing pressure is predicted.

LETTER #37

to the public on both sides. Increased numbers of people in the area would definitely impact the fishery resource.

D Cost

On page I-17 the EIS states that "benefits of public safety, convenience and scenic preservation would be achieved at a cost of $150,000 to $200,000. The cost would stem from road reconstruction, bridge construction and right-of-way acquisition". This cost estimation is erroneous. The landowners are unwilling to sell the right-of-way and if access for the road was condemned the cost for the right-of-way alone would significantly exceed $200,000 since the land in question has a very high market value.

E The EIS failed to consider the adverse impacts and inconveneince that would be experienced by the landowners across whose property the alternative road would be built. Apparently the agencies consider these impacts to be negligible. If the road is constructed we as landowners will be faced with increased trespassing, fire danger, interference with private property (e.g. cattle rustling) and poaching.

F In addition to the myriad of potential problems associated with the proposed road the agencies must undertake a thorough assessment pursuant to the Endangered Species Act of how the alternative would affect peregrine falcon nest site selection. This assessment must be completed before the proposed road can be pursued further.

G Legal Abandonment of Road

The segment of abandoned road between Picket Pin Creek Road and FR 846 west of Horseman Flats was legally abandoned by the Forest Service in 1947 by Cancellation of Right-of-Way

D Please note that Table I-4 of the EIS states that the cost of the Picket Pin Creek road would be $150,000 to $200,000, including land acquisition costs. The text has been changed to be consistent with the table. The selling price of the landowner could significantly increase the cost of this alternative.

E Landowners would notice little difference between the Picket Pin Road alternative and the company's proposal for the following reasons--there would be only a small increase in traffic on the Picket Pin Road--the Picket Pin Road is an existing public road--where the abandoned road would be reconstructed the roads are only 1 mile apart--all but 1/8 mile of the reconstructed road would be on Forest Service land. It is unlikely that there would be a noticeable increase in trespassing, fire danger, cattle rustling, or poaching.

F Comment noted, thank you. The EIS acknowledges that the Picket Pin Road alternative "may affect" peregrine falcons and that it would require U.S. Fish and Wildlife consultation pursuant to the Threatened and Endangered Species Act.

G You are correct that the only alternative for acquisition is condemnation if the landowner is unwilling to sell. You are also correct in that Montana's statute is an inappropriate vehicle for condemnation. However, the authority of the federal government to condemn is authorized in the Act of August 1, 1888 (40 U.S.C. 257) and the Declaration of Taking Act (40 U.S.C. 258a). However, note that the agencies' decision is to retain access to the West Fork trailhead via FR 846.

Easement #139432 (Attachment I). This document clearly states that the right-of-way easement was officially cancelled and dispels any supposition that there is an existing easement across the property in question.

Condemnation

Since no right-of-way easement exists the only other possible althernative for acquiring the property for the road is through Montana's Eminent Domain Statute, M.C.A. 70-30-101. However that law is not applicable in this case.

M.C.A. 70-30-102 states that:

> " . . . . the right of eminent domain may be exercised in behalf of the following public uses: . . . . wharves, docks, piers, chutes, booms, ferries, bridges, of all kinds, private roads, plank and turnpike roads, railroads, canals, ditches, flumes, aqueducts, and pipes for public transportation, supplying mines, mills, and smelters for the reduction of ores . . . . roads, tunnels, ditches, flumes, pipes and dumping places for working mines, mills, or smelters for the reduction of ores; also outlets, natural or otherwise, for the flow, deposit, or conduct of tailings or refuse matter from mines, mills, and smelters for the reduction of ores; also an occupancy in common by the owners or the possessors of different mines of any place for the flow, deposit, or conduct of tailings or refuse matter from their several mines, mills, or smelters for reduction of ores and sites for reservoirs necessary for collecting and storing water. . . . ." (Emphasis added.)

While Montana is one of the few states in the nation that continues to define mining by a private entity as a public use and there are questions surrounding the laws constitutionality the application of the statute is specifically limited to acquiring private property for roads and facilities directly associated with and integral to a mining operation. Even if the statute is construed very liberally it clearly does not provide for the condemnation of private property for a recreational road that

LETTER #37

is neither directly related to providing access to nor integral to SMC's mining operation. To attempt to exercise the statute in such an inappropriate context would result in serious legal and political implications.

Furthermore, such condemnation proceedings would be very costly. M.C.A. 70-30-107 provides that before private property may be condemned for a road ". . . . the necessity of the road and the amount of all damage to be sustained by the opening thereof shall first be determined by a jury, and such amount, together with the expenses of the proceeding, shall be paid by the person to be benefited."

Condemnation by the Forest Service is also inappropriate since there is an existing road which provides ready access to the trailhead even if SMC commences operation.

The proposed alternative is shortsighted and if excercised will result in prolonged litigation and an unnecessary expenditure of time and funds.

LETTER #37

STILLWATER ABSTRACT COMPANY
COLUMBUS, MONTANA

Department of Agriculture of the United States of America,	Cancellation of Right of Way Easement #139432
to	Dated August 22, 1947
G L Torian and his wife, Marie D Torian, Stillwater County, Montana	Filed August 30, 1947, 9:30 AM
	Recorded Deed Book 45, page 29

- This is to certify that the road heretofore constructed upon the right-of-way 60 feet wide across H. E. S. No. 62 in

Twp 5S, R 13 E. unsurveyed and
NW¼ SW¼ Sec 6, Twp 5S., R 14 E.
P.M.M.,

described in the deed made by George L Torian and his wife, Marie D Torian, to the United States of America dated October 5, 1942, and recorded in

Book 40 at Page 46

of the Records of Stillwater County, Montana, is of this day discontinued as a timber or mining road by the United States of America.

Signed at Missoula, Montana, -

F E THIEME
Acting Regional Forester

Acknowledged August 22, 1947 by L Beaman, Acting Regional Forester, Forest Service, Department of Agriculture of the United States of America, "whose name is subscribed to the foregoing instrument" before Ruby M Brome, Notary Public for the State of Montana, residing at Missoula, Montana, with seal. Commission expires Dec 22, 1947.

LETTER #38

RECEIVED
JUN 2 0 1985
STATE LANDS

June 17, 1985
0130 SW Thomas
Portland, Oregon
97201

Re: Stillwater Draft EIS

This new EIS on the joint proposal is a welcome sight when compared to the earlier EIS which was scrapped by the agencies. This EIS still suffers from some major flaws which must be addressed before the document can serve as a "valuable decision making tool" under the National Environmental Policy Act (NEPA) and the Montana Environmental Policy Act (MEPA).

A Of particular concern is the short descriptions given on IN-7 and IN-11 concerning the General Mining Law of 1872 and the no action alternative for the USFS. It is distressing to see that the Custer forest personnel who are charged with regulating activities on federal lands have abdicated responsibility in light of the

A The Organic Administration Act of 1897 authorizes the Secretary of Agriculture to regulate occupancy and use of the national forests for protection and management of national forest resources (see Introduction). The act, therefore, gives the Forest Service authority to set reasonable conditions on entry where the unpatented mining claims are on national forest lands. Although the Forest Service cannot deny entry technically, it can require that the proposed plan of operations meet legal and policy requirements and takes reasonable measures to protect surface resources and public safety. The approval process, including compliance with the National Environmental Policy Act, is evidence of the Forest Service's ability to manage mineral entry in National Forest lands.

Page 2 Stillwater Draft EIS

old adage that mineral lands are open for entry and there is little the Forest Service can do to set conditions on that entry.

B At no point in the document is there any discussion which demonstrates that the USFS has made a determination that the various sightings of ore done by the various (and ever changing) concerns amount to a valuable mineral deposit. At this stage the various entities making up SMC have filed claims, there is no analyses that these claims—individually or lumped together as a whole—constitute a valuable mineral deposit. Absent a determination that the claim(s) constitute a valuable mineral deposit SMC's activities cannot progress beyond the exploration stage.

The USFS' ability to regulate exploration activities on federal

B Neither the National Environmental Policy Act nor the Montana Environmental Policy Act require the agencies to confirm the validity of an applicant's claims that are the subject of its proposed plan of operations. The purpose of the EIS is to evaluate the impacts of the applicant's plan and all reasonable alternatives.

Furthermore, a valid claim is not a prerequisite of approval for a proposed plan of operations. The government is not required to make a legal determination that the claims are valid unless a patent is sought, or operations are proposed in a wilderness. If a company seeks approval of a plan of operations that is the best evidence that the deposit is, in fact, valuable. Location of a valuable mineral deposit (discovery) is not a condition precedent to the approval of a plan of operations.

Page 3 Stillwater Draft EIS

LETTER #38

is well documented. Location of a valuable mineral deposit is a condition precedent to the granting of a permit for activities beyond exploration. The procedure used, complete with a description of the factors involved and the weight given these factors must be clearly outlined in the final document. They should have been included in the draft so that all interested parties could comment

C The Draft EIS fails to quantify income loss to the licensed guides and outfitters that will result as a result of increased access to the Stillwater elk herd. Easy access means correspondent increases in poaching and harassment of game. The elk will respond to such pressure by leaving the area, to the detriment of the hunting public. Quality hunting opportunities are few these days; sacrificing a stable elk population for easier access is a poor trade-off. Much effort has been made to quantify beneficial dollar impacts on the area, the same effort should be made to quantify the beneficial dollar impacts as a result

C Indirect impacts to elk would be caused by increases in the human population rather than improved access. The number of individuals using roads to poach or harass wildlife would not be great enough to cause elk to abandon established ranges. Nor would traffic increase enough to prevent elk use of roadside habitats. However, elk may avoid roadside habitats during hunting season. The Department of Fish, Wildlife and Parks and the Forest Service could alleviate impacts by restricting hunter numbers and access.

Counting cars during hunting season would not indicate recreational dollars spent in the county. The demand for hunting is expected to rise. This would tend to increase, rather than decrease, the expenditure of recreational dollars. The scenario for a decline in hunting dollars spent is contingent upon the Department of Fish, Wildlife and Parks determining that harvest is excessive and subsequently instituting restrictive regulations. Such a scenario is speculative.

Income and employment derived from the guide and outfitting business in Stillwater County is small compared to total county income. There are nine outfitter licenses registered for persons in the study area. Not all of these outfitters make 100 percent of their income from guiding and outfitting activities. Accurate data is not available to determine the income effects of such a small sector on the county economy. Even if guides were to go out of business, total spending by hunters in Stillwater County may not decline noticeably. Many hunters (and other recreational travelers) visit the area and pursue activities without professional guides. As your letter indicates, there are many hunters and recreationists traveling through the area who are not associated with professional guides.

LETTER #38

Page 4 Stillwater Draft EIS

of recreational hunting dollars being spent in Stillwater County. USFS & DSL personnel should simply count the vehicles using the upper country during hunting season as a first step. Decreasing the quality hunting that is currently available will mean less recreational dollars being spent in Stillwater County.

D One additional point must be made. The ranking of sites by visual impact criteria is backwards. The public should see the mine and its attendant facilities; thus, rankings in which the public views the mine and facilities should be preferred, not discouraged. The mine and attendant facilities should be easily viewed by the public so the public knows how its federal lands and resources are being used. Hiding unattractive industrial sites from the public's view means only that the locals (those who would use the less traveled routes) aesthetic sensibilities will be affronted. It's public resources, the public ought to see how they are used.

D The objectives of the mitigating measures and alternative Picket Pin Road access are to reduce visual impacts. The proximity of the mine to FS 419 will provide opportunity for the public to observe the company's operations. In addition, agency inspections will provide oversight of the operation.

LETTER #38

Page 5 Stillwater Draft EIS

E In sum the drafters of this EIS must demonstrate that a valuable mineral discovery has been made before they can grant permits to SMC for activities beyond exploration.. I eagerly await such a demonstration.

Please put my name on all mailing lists connected with this project

Very truly yours,

Stephen A. Doherty

Steve Doherty
0130 SW Thomas
Portland, Oregon
97201

E Such an evaluation is beyond the scope of both the federal and state environmental policy acts.

LETTER #39

United States Department of the Interior
GEOLOGICAL SURVEY
Water Resources Division
2525 Fourth Avenue North
Billings, Montana 59101

May 29, 1985

Mr. Kit Walther, Chief
Environmental Analysis Bureau
Montana Department of State Lands
Capitol Station
Helena, Montana 59620

RECEIVED
JUN 04 1985
STATE LANDS

Dear Mr. Walther:

Several members of the Water Resources Division of the U.S. Geological Survey have reviewed the geology and hydrology sections of the draft envioronmental impact statement for the Stillwater Mining Company Stillwater Project near Nye, Montana in Stillwater County. Following is a list of comments from this review.

A 1. Page IV/Summary, Hydrology (Proposal) 2nd paragraph, ***added mine-related sediments would be undetectable.

Comment - The added mine-related sediment may be laden with toxic substances and carried downstream to be deposited. It would seem as though they would be in serious threat to the downstream environment from that point on in time.

B 2. Page SMC Proposal/II-17, Monitoring, 1st paragraph. There is a need to be specific in regards to parameters to be measured--does it include biological monitoring of any sort or suspended sediment. A list of parameters and the exact sampling locations should be given. In addition, sampling and laboratory techniques should be addressed. Would trace metals be analyzed as dissolved, total, or total recoverable?

C 3. Page III-12/Hydrology, 2nd paragraph. As a point of interest, the high flow of the USGS surface-water station 06202510 Stillwater River above Nye Creek, near Nye, MT was 6400 ft^3/s on July 10, 1983 and the low flow was 23 ft^3/s on March 6, 1981.

D 4. Page III-13/Hydrology, 3rd paragraph, 1st sentence. ***(total rather than dissolved). Do the analyses have total or total recoverable.

E 5. Page III-13/Hydrology, 3rd paragraph, last sentence. The EPA now has some evidence that some aquatic organisms are affected by metals associated with sediment.

F 6. Page III-13/Hydrology, 4th paragraph. Is the cadmium in the Stillwater River higher than the EPA standard of 10 mg/l at low-flow periods.

A Only very high flood flows, in excess of the 1000-year flood would encroach on the base of the tailings impoundment. Sediment introduced into the river would be material from the embankment and not tailings. The amount of sediment from the embankment would be a minor portion of the sediment load during a flood of 1000-year magnitude.

During operation of the mine, the tailings impoundment would have a protective containment dike around the base of the impoundment which would trap runoff and sediment from the dam face, preventing sediment from reaching the river.

B State and federal environmental policy act regulations and guidelines do not require that specifics of monitoring plans be addressed in EISs. Such a discussion would not add any substantive information to help the reader evaluate the potential environmental impacts of a proposed project. SMC would be required to monitor both surface and ground waters. Before SMC could begin construction, a monitoring plan would have to be approved by the agencies. The approved monitoring plan can be reviewed on request at the DSL and U.S. Forest Service offices.

C The text has been rewritten incorporating the U.S. Geological Survey's flow information.

D The cited analyses were for total metals rather than total recoverable metals.

E Comment noted, thank you. Studies to determine if existing metals concentrations in the Stillwater River are limiting biological productivity of periphyton or aquatic organisms have not been undertaken.

F Occasionally, during low-flow periods, cadmium exceeds EPA's criteria for freshwater aquatic life (0.01 mg/l at a hardness of 50 mg/l $CaCO_3$ equivalent).

LETTER #39

G 7. Page III-13/Hydrology, 5th paragraph, 1st sentence. The source of these ions may also be by dissolution of rocks by ground water.

H 8. Page III-14/Hydrology, 4th paragraph, last sentence. Is this also true of the total metals and sediment?

I 9. Page III-15/Hydrology, 3rd paragraph, 2nd sentence. Rather than state the "water was good enough" include a statement that measured parameters did not exceed criteria established by the EPA for drinking water.

J 10. Page III-17/Hydrology, 2nd and 3rd paragraphs. Some confusion may occur by using the name Castle Creek for the central drainage of Hertzler Valley. The Mt Wood topographic map does not name this drainage; however, there is a Castle Creek that enters the West Fork of the Stillwater River in the NW¼SW¼ Section 26, T.4 S., R.15 E. Sediment, water quality, and streamflow data has been collected and published for this location. It is suggested the name Castle Creek be dropped and the term unnamed drainage be used.

K 11. Page III-20/Hydrology, 1st paragraph, 1st sentence. ***without a noticeable reduction. In what is there a noticeable reduction.

L 12. Page VI-10/Appendix B, Flotation Process, 1st paragraph. The statement is made that there could be changes in the chemicals used. It must be remembered that all chemicals introduced into the tailings pile will eventually be introduced into the ground-water system, whether at the mine site or Hertzler Valley site.

Sincerely yours,

Richard D. Feltis
Subdistrict Chief

G Comment noted, thank you. The text has been revised.

H Suspended sediment and most of the metals values in the tributaries are highest during peak-flow conditions.

I This sentence has been reworded as per your comment.

J Thank you for clarifying this. The sentence has been rewritten.

K This sentence has been reworded to indicate the alluvium is capable of producing several hundred gallons per minute on a sustained basis.

L Most reagents that could be substituted would have similar physical and chemical characteristics.

Advisory
Council On
Historic
Preservation

The Old Post Office Building
1100 Pennsylvania Avenue, NW, #809
Washington, DC 20004

Reply to: 730 Simms Street, Room 450
Golden, Colorado 80401

CUSTER NATIONAL FOREST
STATE LANDS

LETTER #40

June 18, 1985

Mr. David A. Filius
Forest Supervisor
Custer National Forest
P. O. Box 2556
Billings, MT 59103

Copy to [illegible]
DSL

REF: Draft Environmental Statement (DES) for the Stillwater Mining Company's proposed platinum and palladium mine in the vicinity of Nye, Montana

Dear Mr. Filius:

The Council has reviewed this DES and notes that the Forest Service must approve the plan of operations for this undertaking. We also note that twenty-three historic properties (archeological, architectural, historic, and cultural properties) were identified in the area of impact of the undertaking. It has been determined that several of these historic properties may be eligible for inclusion in the National Register of Historic Properties.

As Forest Service approval of the plan of operations for the proposed mining operation is required, Section 106 of the National Historic Preservation Act requires the Forest Service to obtain the comments of the Council if it determines that historic properties eligible for the National Register will be affected by the proposed mining project. The Forest Service should consult with the Montana State Historic Preservation Officer to determine whether there is an effect on eligible historic properties.

Pending completion of compliance with Section 106 through the steps detailed in the Council's regulations, "Protection of Historic and Cultural Properties" (36 CFR Part 800), the Council considers the DES incomplete in its treatment of historic properties.

Comment noted, thank you. Both the Montana SHPO and the advisory council were consulted throughout the EIS process.

LETTER #40

If we may be of assistance in answering questions or expediting compliance with Section 106 of the Act please contact Brit Storey at (303) 236-2682 or 776-2682 (FTS).

Sincerely,

B.H. Storey

Robert Fink
Acting Chief, Western Division
of Project Review

LETTER #41

11 June 1985

RECEIVED
AUG 20 1985
STATE LANDS

Mr. Kit Walther,
EIS Team Leader
Montana Department of State Lands
1625 11th Avenue
Helena, MT 59620

Dear Mr. Walther:

You will please find enclosed my written comments on the draft EIS for the Stillwater Mining Company Stillwater Project. These comments, in their entirety, are submitted to be part of the written record for the final EIS.

Thank you.

Sincerely,

M. Douglas Scott

M. Douglas Scott, Director
Institute of Natural Resources

MDS/ss

LETTER #41

Comments on the Draft Environmental
Impact Statement - Stillwater Mining
Company Stillwater Project, authored
by the Montana Dept. of State Lands
and the USDA Forest Service

M. Douglas Scott, Director
Institute of Natural Resources
Montana State University
Bozeman, Montana 59717

This draft EIS is much improved over the previous draft EIS for the Anaconda Minerals Company Stillwater Project. It more thoroughly analyzes alternatives, and represents many hours of work by public servants within the Montana Dept. of State Lands and the U.S. Forest Service. The following comments are offered in an effort to help the EIS to address a few more items so that the public can more fully evaluate all alternatives.

A The "no action" option - legal precedent

On pages IN 10 and 11, it is implied that the USDA Forest Service cannot deny a mining operation on these Public Lands because they are open to mineral location and entry. This idea is in error. Over 10 years ago, other federal agencies took this same stand, (that denial of a permit for an operation was outside of an agency's jurisdiction, and couldn't be done under NEPA). This was soundly put to rest by two now-famous Federal Court decisions: Environmental Defense Fund vs Corps of Engineers, and Natural Resources Defense Council vs Morton. The courts determined that federal agencies have to include the whole range of reasonable alternatives in an EIS, and one of these is to consider not having any development. Regardless of an agency's other responsibilities, it must evaluate major projects under the full provisions of NEPA, and enforcement of NEPA takes precedence over other goals.

I have attached two separate reviews of these cases from "Federal Environmental Law" and "A National Policy for the Environment". They clearly show that the "No action option" (meaning to deny a permit, not just simply to ignore the project) must be considered to fulfill NEPA requirements. The basic philosophy seems to be this (for an industrial project): The EIS needs to tell the public what are the best environmental control and reclamation techniques that can be employed, while still allowing the company to make reasonable profit. If the best techniques, that allow a profit, are not good enough to reasonably safeguard the environment, the permit must be denied. If the techniques are good enough, the permit should be issued.

A Neither of the cited cases holds that the USFS may deny an operations plan for mining on its land. Furthermore, even if we assume that the USFS has denial authority. Your assertion that NEPA requires an agency to give precedence to the environmental goals contained in NEPA over other agency goals is in error.

To be sure, the Court of Appeals in EDF v. Corps of Engineers, 470 F. 2d 289 (8th Cir. 1972) held that the agency must, in the required good faith, consideration, and balancing of environmental factors, give sufficient weight to those environmental factors.

However, in Vermont Yankee Nuclear Power Corp v. NRDC, 435 U.S. 519, 558 (1978), the United States Supreme Court held that "NEPA does set forth significant substantive goals for the Nation, but its mandate is essentially procedural." In 1980, the United States Supreme Court expanded upon Vermont Yankee as follows:

> Vermont Yankee cuts sharply against the Court of Appeals' conclusion that an agency, in selecting a course of action, must eleviate environmental concerns against other appropriate considerations. Strycker's Bay Neighborhood Council v. Karlen, 444 U.S. 223, 227 (1980).

In Stryker's Bay, the Court of Appeals, had held the Department of Housing and Urban Development had violated NEPA by approving a proposed site for a low-income housing project when an alternative site would have had less environmental impact. In making this decision, HUD had determined that the delay involved in developing the alternative site must override the environmental consequences. In approving HUD's action, the Supreme Court stated:

LETTER #41

This EIS does not consider the "No action" alternative at any time, yet it is apparently being (partly) used to satisfy NEPA requirements for the USDA Forest Service. At present, the EIS does not meet those clear legal requirements. The "No action" alternative must be compared to the other alternatives. Of course, this "No action" alternative is also required under the Montana Environmental Policy Act, since that act is nearly a copy of NEPA. This should encourage the Dept. of State Lands to consider the "No action" option also.

B A review of major environmental values in the area

The following is a list of the particular values of the project area, which I think helps to set the standard for whether or not it deserves special environmental protection. All of these largely occur within 2 miles (and usually much less) of the various project disturbances.

1. The area borders the Absaroka - Beartooth wilderness, which is of National importance for recreation.

2. One of the major access roads for hikers and campers in the wilderness, passes next to the site.

3. The area is heavily used by citizens of Montana's largest city; Billings. It is safe to say they come for scenic outdoor values, - not to see industrial development.

4. The upper Stillwater River next to the mine site provides spawning beds for rainbow and brown trout from throughout the Stillwater River, and even from the Yellowstone River. It also is a rearing area for juvenile fish, which then disperse widely.

5. The area winters several hundred mule and white-tailed deer.

6. It winters about 50 bighorn sheep - one of the most highly prized game mammals in North America.

7. Over 100 elk winter in the area or near it.

8. Two endangered bird species, the bald eagle and peregrine falcon, use the immediate area. (The peregrine falcon is so extremely rare that use is sporadic.)

9. Another important, federally-protected species, the golden eagle, often uses the area.

It is hard to think of a place in Montana, short of the middle of Glacier or Yellowstone Parks, that has as many high environmental values in such

> . . . there is no doubt that HUD considered the environmental consequences of its decision to redesignate the proposed site for low-income housing. NEPA requires no more. Strycker's Bay, supra, 444 U.S. at 228.

If EDF v. Corps of Engineers does indeed stand for the proposition that agencies must give precedence to environmental goals over other agency goals, it has been overruled by the United States Supreme Court. Please note that the no-action alternative is discussed in the final EIS.

B Comment noted, thank you.

LETTER #41

a small area as the upper Stillwater. This EIS needs to seriously consider the "no action" alternative and, at the least, the highest possible environmental controls should be used if development takes place. If these EIS concepts are not employed here, where would there be a better place?

Some of the special environmental precautions that need to be taken are discussed below.

C1 Tailings pond effluent and Stillwater River water quality

A quote from the USDA Forest Service publication Gen. Tech. Report INT-35 (1977: p. 67) seems appropriate: "Again, old abandoned tailings are often a major problem. Dissolved metals and salts, in highly toxic solutions, are sometimes found leaching from mill tailings. Modern practice is to remove this material where it is at all feasible to do so."

The following facts from the EIS apply:

C2 1. The Montana Dept. of Fish, Wildlife and Parks consider the upper Stillwater a substantial fishery resource (III-38)

C3 2. Trout spawn in the area, and a majority of the young stillwater fish are reared there (III-39). (Also, eggs and fry are much more susceptible to toxic substances than are adults.)

C4 3. The coarse grained alluvial gravels in the Stillwater Valley have high flow rates of 200-400 feet per day. (III-21)

C5 4. Nye creek, which is polluted with old mine tailings, had only 6 invertebrate species, compared to 17-46 for Stillwater River stations (III-37).

C6 5. Ground water quality below the existing percolation ponds has been significantly lowered already by a factor of 10 (for nitrates - III-21).

C7 6. Ground water quality beneath the old chromite tailings ponds exceeds drinking water standards for several toxic metals (III-23). (It is a little silly to suggest these metals came up from bedrock when other wells not under tailings don't show the problem.)

C8 7. Soils of the area are quite porous (III-26). They are expected (after reclamation) to have low water holding capacity (IV-21) and water would be lost to leaching (IV-15). (Of course, replacing soil in 2 lifts will not eliminate this problem, especially since most of the 23.2 inches of precipitation occurs in March - June (III-55). Much of this will filter in the soil profile in early spring when plants are dormant, and evaporation is low. Even 15 inches per year will send plenty into

C1 The U.S.D.A. publication distinguishes between old and new (modern) operations. We agree that old abandoned mine tailings are often a problem because of dissolved metals and toxic solutions. We agree also that modern mining practices remove substantially larger quantities of environmentally hazardous metals in their tailings wastes. Such would be the case with the SMC operation.

C2 Comment noted, thank you (cite is from EIS).

C3 Comment noted, thank you (cite is from EIS).

C4 Comment noted, thank you (cite is from EIS).

C5 Comment noted, thank you (cite is from EIS).

C6 Comment noted, thank you (cite is from EIS).

C7 The text identifies two sources; the old chromite tailings and seepage from bedrock. A bedrock source, responsible for possibly a portion of the observed metals values cannot be ruled out for reasons given in the text.

C8 We agree that salvaging and replacing soils in two lifts would not eliminate the problem of low postmining water- and nutrient-holding capacity; however, this measure would certainly decrease the magnitude of the impact.

LETTER #41

the subsurface.)

C9 8. Up to 10% of the metals will remain in the tailings (VI-10).

D The problem

All of the above facts point to the following conclusions.

1. The tailings will produce leachate.

2. In an unlined pond, the leachate will reach the groundwater system.

3. The toxic material in the ground water will exceed water quality standards.

4. The toxic water will move very rapidly to the Stillwater River.

5. The amount of toxic ground water dilution at low flows in the stream is unknown - especially after a few years when tailings would more completely influence the groundwater.

6. The EIS has not identified what level of heavy metals would be toxic to fish eggs and fry in the upper Stillwater River.

7. The problem would continue virtually for hundreds of years. The mine closes in 30 years. All the EIS writers will be gone in 50-60 years. (The "old" mine problems of 40 years ago are very apparent today.)

E The solutions

To avoid monumental headaches years down the road, the following need to be done with the tailings pond.

1. Line the bottom with Hypalon.

2. Keep it as far as possible from the river.

3. Keep the pond as small as possible. (This means backfill the mine with as much of the tailings as possible.)

4. Keep the pond as stable as possible - meaning build a good, solid earthen dam.

5. Prevent water infiltration into the reclaimed pond surface. Methods could include:

a. Import clay soil for a 6"- 12" cap before topsoiling.

b. Build a stable rock and clay-drainage network over the top of the

C9 This is correct. However, the metals values of the ore to begin with are very low. In addition, concentrations of dissolved metals in SMC's bench test tailings water are extremely low. Seepage from the lined pond would be in the order of 10-15 gpm. Dilution by ground water and surface water would reduce concentrations of all dissolved metals to well below levels considered harmful to aquatic life (see Appendix D).

D SMC's pond would be lined. Construction and operation of this pond would not measurably change ground or surface water quality. After mining, the pond would be dewatered, regraded, and revegetated. After reclamation there would be little, if any, movement of water through the tailings because evaporation losses would generally exceed available moisture. As a result, seepage rates from the reclaimed pond would be low. Seepage would be diluted by ground water and surface water. Constituent concentrations in the Stillwater River would not exceed water quality criteria.

E Several of the solutions you have suggested are a part of the company's proposal evaluated in the draft EIS. Since publication of the draft EIS, SMC revised its mine plan. In order to control rock spalding within the mine and ore dilution, SMC now proposes a cut-and-fill mining method. Thus, about half of the tailings will be backfilled into the empty stopes. In addition, SMC will install an underdrain system. The final EIS has been revised to reflect these changes.

LETTER #41

100+ acre reclaimed pond. Just grading to a nice smooth "dome shape" will not stabilize it for long. Nature will soon cut her own channels, which could then break the dam. If this happens, rapid erosion would liberate the tailings. If tailings somehow get to the River, they could quickly choke spawning beds.

6. Also, decrease the outslope of the dam to a 20% grade, not 50%. This is the same standard that DOSL requires of reclaimed coal mine spoils. Revegetation and stabilization of the bank would be much more certain.

F Considering the proposed action, and the 6 alternatives in the EIS, there is only 1 that comes close to meeting the solutions offered above. This is option #6, the Hertzler Valley - mine backfill approach, but with a Hypalon pond lining. This also offers the considerable advantages of screening the pond from view more adequately, and lessening the potential for massive crown pillar collapse (through backfilling the mine).

G The costs for the various project alternatives, on page II-32 of the EIS, are not detailed enough for a reader to determine if they are accurate. It is not even stated clearly if these are annual outlays for the various options, or if these are totals for various capital and operating costs over a 30 year period. I suspect the costs are not accurate. For instance, changing from option 2 to 3 means adding a mine backfill, and this raises the cost by $6.88 million dollars. Changing from option 5 to 6 also means adding the identical backfill method, but the cost jumps by $10.62 million! (This option also entails building an earth versus sand dam, but would this really cost nearly $4 million more?)

H Page IV-61 indicates the gross annual mine proceeds would be about $23 million. At this rate, can the mine afford to construct an improved option #6 tailings disposal system, and still make a reasonable profit? If they can, maybe the project should go forward. If they can't, either this high quality environment is going to be much more severely compromised by less reliable environmental technology, or else the project will have to be given up. The final EIS should give us the answer.

F Comment noted, thank you.

G The cost estimates to which you refer are on page II-22 of the DEIS. The paragraph following Table II-2 that lists costs of project alternatives states that the estimates are accurate to only ± 25 to 40 percent. Furthermore, the discussion notes that this type of estimate made from only a rough, conceptual project plan is generally within that level of accuracy. Cost estimates (for the alternative selected) are refined later when the project nears construction. Such practices are standard for the industry. The footnote on table II-2 notes that the costs are total costs including capital and annual operating costs.

As noted in the previous paragraph and in the EIS, these costs may vary substantially from final project construction costs. The backfilling operation is estimated to add about $3.0 million in capital costs and between $4.50 to $5.00 per ton in operating costs, which increases the cost difference between alternatives 2 and 3.

Alternatives 5 and 6 are different in two important respects. Alternative 5 employs shrinkage stoping and hauling the ore by truck to a mill and cyclone tailings impoundment in Hertzler Valley. Alternative 6 has backfill of the stopes, the mill at the mine, and slurry transport of tailings to an earthen impoundment in the Hertzler Valley. The backfill operation is estimated to cost between $4.50 to $5.00 per ton and the earthen dam is estimated to cost about $4.0 million. Both of these estimates are preliminary and may vary from more refined studies. For example, the company assumed that material to build the earthen dam would have to be shipped to the Hertzler site. If the company were to determine that adequate material is available on site, the cost of an earthen impoundment in the Hertzler valley may be lower than $4.0 million.

H The company indicated that all alternatives were economically feasible when DSL requested cost data for each alternative. It is beyond the scope of an EIS to determine company profitability for each alternative. The EIS determines project impacts, selects an environmentally preferred alternative, and identifies mitigations. The company will make the final determination as to whether the project should go forward.

Oversights

LETTER #41

	Page	Problem		
I	v-summary	Based on the discussion at the last of page iv it appears the suggested impacts for Aquatic Ecology (Proposal) and (Alternative 4) are reversed.	I	The summaries are correct.
J	IN-9	P. I-17 and elsewhere suggest a new Bridge on FR 140 would be needed. Thus, a 404 permit likely would be needed.	J	Comment noted, thank you.
K	I-9	Alternatives 1, 3 and 6 are backfill types.	K	Comment noted, thank you.
L	I-11	There are 10, not 11 portals shown in the top figure.	L	The 5,000 elevation portal would have 2 openings; thus there would be 11 portals in total. One of the two openings would be a raise. Therefore, it is not noted on the figure.
M	II-6	Dunnet, 1971 is not present in literature cited. National Academy of Sciences is not cited correctly. Jolly, 1978 is missing in literature cited.	M	The text has been corrected.
N	II-16	This map has no scale. How close is the dam toe to the Stillwater River. 350 feet?	N	About 325 feet.
O	II-22	U.S. Bur. of Mines reference is not present. Backfilling occurs in alternatives 1, 3, 6 not 2.	O	The U.S. Bureau of Mines (BOM) reference is included in Table II-22. The discussion following the table was not drawn from the BOM document.
P	III-22	What are the units in this table?	P	The values are in mg/1. The table has been corrected.
Q	III-39	The number of rainbow trout/1000 ft of stream at peak spring spawning appears to have been omitted. This is essential, to know the value of the fishery.	Q	Pages III-38 through III-40 of the draft adequately characterizes the fishery.
R	III-44, 45	The 8 mule deer survey units are not identified in Figure III-2.	R	Adding the survey unit boundaries would make the graphic more difficult to use and would provide no essential information.
S	III-68	Fifth paragraph. Eight, or Eighty percent?	S	Thank you for the comment. The text has been corrected.
T	IV-5	Last sentence. The words "could" need to be changed to "would" to make these required mitigation techniques.	T	Mitigating measures that would be required as part of the preferred alternative are identified in Chapter 1.
U	IV-79	Alternative 2 says the dam would be 150 ft. high. Pages II-19 and I-1 say it would be 125 ft. high. Which is it?	U	A tailings dam at the Stratton Ranch site could be anywhere from 100- to 150-feet high depending on the configuration of the dam. For the sake of consistency, we have chosen a dam height of 125 feet. (Note: text change Chapter IV, Aesthetics).
V	VI-19	Festuca idahoensis	V	Thank you for the comment. The text has been corrected.

LETTER #41

W VI-22

Odocoileus virginianus
Oreamnos americanus

Lastly, this EIS needs a decent map of all roads that are discussed. The west fork and main fork of the Stillwater, plus the potential mine disturbances and 3 main tailings pond options should be shown on the same map. Figures S-1, I-1, I-3 and I-4 do not do this. It is impossible to tell how far the Stratton and Hertzler tailings dams would be from the Stillwater River in this EIS.

W There is no need to change the maps presented in the EIS. The Stratton Ranch dam would be 600 to 1,200 feet from the river. The Hertzler Valley site would be about 1.5 miles from the Stillwater River. SMC's proposed dam for comparison would be about 325 to 600 feet from the river. These distances have been included in Chapter II.

TESTIMONY #1

FRANCIS WOLCOTT:

	I have reviewed the draft Environmental Impact Statement for the Stillwater Mining Company Stillwater project and have several comments. I hope to add to these with a written statement shortly.		
A	First - Alternative 6 seems to be the best possible as it minimizes adverse effects of the operation, partly by including back-filling of the stopes with the advantages that I will mention later, puts the mill close to the mine, and provides the least damaging site for the tailings pond. Alternative 4 is not bad. The advantages of the Hertzler Ranch for location of the tailings pond appear to outweight the disadvantages, and a short slurry pipeline with return of the water to the mine is far preferable to the previously suggested trucking of ore or tailings. However, the suggestion for an underdrain system rather than lining the pond raises some questions.	A	Thank you for your comment.
B	Alternative 1 is preferable to the proposal because of the backfilling, but the location of the tailings pond for either seems to have too many disadvantages. The Stratton Ranch seems to be a poor location and both alternatives 2 and 3 should be rejected. Alternative 5 is much the same as the earlier Anaconda proposal and the objections raised then still apply. It is an unsatisfactory alternative and should be rejected.	B	Thank you for your comment.
C	Cost estimates indicate, not surprisingly, that the more desirable alternatives would incur the highest costs. It should be accepted that users of platinum group minerals should pay all the costs of extracting them with minimum adverse effects on those nearby the mining operation and not benefitting from it. The additional costs from more satisfactory alternatives are not all that excessive and better place the actual cost of production on those who need or want the mineral rather than on the innocent bystander.	C	Thank you for your comment.
D	Cut-and-fill stoping appears then to be the preferable mining method. It would not only provide better ground support, but would reduce the size and therefore any impacts of the tailings pond. The only offered objection to this method is increased cost to the mine operator rather than a "minimal" or possibly greater future hazard of subsidence and the larger tailings impoundment, imposing the operator's savings on the public as additional costs.	D	Thank you for your comment.
E	It is noted (on page IV-3) that "Future major earthquakes could speed the deterioration of the crown pillar after mine abandonment." This should be considered as a major point. We must be concerned with a long-term future and the effect of present actions on what results are potential in such a long-term future. Earthquake records over only a 30-year time frame seem wholly inadequate to make any judgement as to possible future earthquakes and precautions must be taken now in planning operations so as to avoid as much as possible significant potential adverse effects at any future date. Page IV-6 suggests that "the agencies could retain sufficient bonding to correct subsidence problems should they occur." This is inadequate. They should do so. It should be noted that proper long-term management of surface resources and their protection is a specific responsibility of the Forest Service on National Forest land.	E	Thank you for your comment.

TESTIMONY #1

F The tailings pond site suggested in the proposal seems to be very intrusive. It is a large pond and the height of the dam would make it overly apparent. As it is very close to the Stillwater River, any dam failure would cause unacceptable damage. It should also be noted that wind velocities at this site are likely to be considerably greater than projected on many occasions. The Hertzler Ranch site would overcome most of these objections. There must be reasonable assurance that the underdrain system rather than lining would adequately protect ground water. It is also important to insure that all possible safeguards be designed into the slurry line.

G There need to be provisions for unexpectedly large amounts of water from the mining operation. It did happen before, when a massive volume of water was encountered, and there should be plans available to cope with such an incident again.

H The suggestions for reclamation seem good. It is essential to avoid introducing any noxious weeds. Perhaps if a mulch application is used it should be repeated for at least a second season to improve the potential for adequate revegetation and soil stability. Planting of an annual cereal grain crop should be encouraged. The treatment suggested on page IV-19 is excellent and should be required.

I There must be assurance of no disruption of peregrine falcon nesting and also concern for bald eagles. Requiring scheduling of heavy equipment activity to avoid adversely impacting the falcons would help.

J There is inadequate presentation of any advantages to the proposed portal arrangement as contrasted with the alternatives, other than the facilitation of mine backfilling, which seems a preferable mining method, and for that reason alone the proposal may be best. Otherwise the disadvantages pointed out would seem to suggest the unsuitability of the proposed arrangement.

K There is not yet adequate information to comment on power-line alternatives. On-site generation is clearly undesirable because of effects on air quality in a relatively high-standard area. Any large power line should be constructed so as to minimize effects on eagles and falcons.

L The alternative to the West Fork access proposal would seem to have considerable effect on peregrine falcon nest siting. Adequate mitigation is essential before this alternative can be acceptable.

M There are many effects on social and community service concerns that must be considered. Solid waste disposal is a problem now. The greenbox program is definitely near capacity. The site designated for use by Absarokee residents is inconvenient and the alleged "all-weather road" is marginal at best. The "private collection system" for Absarokee is available, but not required nor used by all Absarokee residents and utilizes the same site anyway. Any increased need will require major improvements and perhaps relocation, or even a totally revised and different disposal system.

N The present sewer system serving Absarokee is inadequate and the potential for adequate improvement seems minimal. Additional demand on the system would make things worse.

F Thank you for your comment.

G The company's proposed percolation ponds would be built to handle 500 gallons per minute of mine water and the mill would acquire about 350 gpm make-up water. The total capacity of 850 gpm would be much more than the amount likely to ever be produced by the mine. (Note: To date, the mine produced a maximum of 350 gpm and probably would not exceed that amount during operation.) If, for some reason, the mine workings were to produce more than 850 gpm, SMC probably would be allowed to discharge some of the mine water directly into the Stillwater River (according to their Montana Pollution Discharge Elimination System Permit) since the quality of ground water within the mine area is quite good.

H Thank you for your comment.

I Thank you for your comment.

J Under the preferred alternative, 9 new portals would be built. The additional portals would allow the company to access the ore body easier and facilitate backfilling of mine stopes with mill tailings. The environmental advantages of backfilling the tailings more than offsets the slight negative visual and wildlife impacts of the additional portals; the surrounding area has already been disturbed by extensive road and mining activities.

K Thank you for your comment.

L Thank you for your comment.

M
N
O The hard-rock mining impact plan, co-authored by the county and the company, addresses impacts to services and facilities provided by local area governments and to area roads. The plan specifically covers solid waste disposal, the Absarokee sewer system, and area road improvements. The plan obligates the company to pay $2.3 million to mitigate impacts to local-area governments (p. IV-56 DEIS).

If there are problems with the existing services and facilities, the company is not obligated to rectify such situations. The company is required only to mitigate problems caused by its operations. The hard-rock mining impact plan defines the extent of company impact to local-area governments and designs mitigations. The plan has been approved by the county.

TESTIMONY #1

O All area roads are at best minimally adequate for present traffic and need major improvements if traffic loads increase. Repair schedule appear to be well behind need if mining operations start, adequate funding is not available and repair operations could conflict with increased traffic.

P Housing needs could create a problem. Location of the housing for mine workers is critical. Especially for temporary construction workers it would seem desirable to provide temporary housing close to the mine site, perhaps on the Hertzler Ranch. There should be an attempt made to encourage all mine employees to live as close to the mine as possible. Worker transportation problems would be eased considerably by bussing and this should be encouraged or required.

Q Housing construction could be a long-term detriment as construction for satisfying demand and need during mining operations would create a considerable over-supply after the mine closes. At that time it is unlikely that there would be adequate employment available to provide jobs for that many people, and the area could wind up with a considerable number of empty houses. It would seem wise to take this into consideration when planning for housing for employees moving into the area.

R Very careful consideration needs to be given to the effect of mine closure. If a significant number of persons remain in the county seeking other employment that will place a burden on the county welfare structure as well as cause increased competition for the few remaining relatively permanent jobs nearby. It must be realized that most or all of the project 83 additional non-mining jobs would also end. Temporary closures could have a considerably greater impact as most or all laid-off workers would remain in the area expecting to be rehired. Closures, permanent or temporary, would result in sharply reduced personal income in the county at the same time as a reduction in county tax income, a great number of people with suddenly nothing to do, and perhaps other difficulties. Without planning and funding to mitigate these effects, especially of such temporary shut-downs, not an unlikely possibility, there will be a burden on the county and the long-term residents. The platinum market, judging from recent years, is not secure, and such closures seem likely. Since interruptions in payroll are not unlikely and the outlook for agricultural income will probably not be substantially improved the intensification of instability in total personal income in the county seems probable and undue optimism as to significant economic benefits is unwise. There are many difficult problems here which need careful consideration and reasonably sure solutions.

P The company has proposed construction of worker housing at the Stratton Ranch. If the camp were built and workers lived there, housing and transportation impacts would decrease. If the camp is not constructed, transportation impacts would be moderated by the company plan to foster carpool, to provide a bus service, or to follow other measures.

If the camp is not constructed, there are steps that the company and county could take to moderate housing problems. The county can adopt zoning regulations to affect location of housing development. The company can alter scheduling so that the construction and operation crews are not hired concurrently, creating excess one-time demands on housing. The new-phased development (construction of the mill in the second year) should help moderate initial short-term housing demand.

Q If the company constructs the proposed worker camp, housing impacts will decrease. If the camp is not constructed, housing impacts could be greater (see responses M, N, and O). After permanent closure, mine workers may or may not leave the area. If unemployed people were able to find other jobs in the county or in Billings, they may choose to remain in the area and commute. In that case, there would be little or no impact on housing. However, if they were unable to find jobs, they may leave. There could be a temporary over supply of houses, until markets and the population adjust to the changed conditions.

R The effects of mine closure are difficult to predict and will depend on a number of circumstances. If there are sufficient local-area employment opportunities, closure impacts could be moderate. Given the proximity of Billings, unemployed workers have a wider labor market area than just Stillwater County. Planned closures also allow employees time to consider alternatives and search for new jobs. Although some unemployed workers may experience situations that result in impacts to the county welfare structure, to assume that such impacts would impose undue hardship on county finances is premature. See all pp. IV-60 of the draft EIS for a description of assistance available from the hard-rock mining trust account to local governments affected by mine closure.

TESTIMONY #2

JOHN MOUAT:

Ladies and gentlemen, and distinguished guests, I don't know them all, the Forest Service and other state services. I am John Mouat. My wife and I, Carolyn, and I own and operate the Stillwater Ranch which is adjoining the proposed millsite. It was also adjoining the old millsite when it was operated by American Chrome Company. We operate a first-class riding, pack trip, fly fishing operation. Thirteen programs in total varying from $350 a week to $1,000 a week. We're full most of the time. We work hard at it and we've spent a lot of time building it up. I would like to address my comment totally to environment, but I would like to add one thing that you did not contain in your statement, Mr. Walther, and I'm sure everything was well considered, but this one was not thought of at all and I would like to touch upon it. I would like to suggest very briefly, the past, present, and future of the environment of a mining operation such as this. Before you can evaluate the environment of a mining or any other operation. You've got to look back and find out what happened to a previous operation. I read recently in one of the newspaper articles that Mr. Walther talked about, of a gentleman saying that the American Chrome Company operated a clean show. That is pure baloney. American Chrome Company finished their contract with the government and walked away from that leaving a filthy abomination and obscenity which has polluted that entire area for the last 15 years. I am going to tell you very briefly how. When they walked away from it they turned their pumps off. The settling pond dried up and, as Mr. Francis said, the winds were much higher. They get up to 120 miles an hour. The settling pond became and the area downwind from it became the Sahara Desert during a vast windstorm. I lived there. The gentleman that said that they did a good job didn't. We had to put up with winds of up to 120. Anywhere beyond 40 miles an hour you couldn't see the mountains from our ranch house. It moved millions upon millions of tons of that coal tailings from the settling pond over onto Mr. Jaquith's Forest Service and onto my land. Now he wasn't there then, you can't hang that on him. I don't know who was, but it is still there and anyone who doubts it I ask you come and visit me. Nye Creek, that beautiful 1,200-foot waterfall that you see coming over the mountains, guess what, it never reaches the river now. Why doesn't it reach the river? Because Nye Creek is filled with these tailings. Every year it is filled with tailings and in the spring it comes down and goes into the creek in its beginning, but during the winter so many tailings flow into that creek 10, 15, 20, 25-feet deep. The water goes in at the top and it never comes out at the bottom. It is as dry as a bone at the entrance to the river. And when the spring runoff comes, guess what happens. It all comes down on me, my hay, my animals, my shelter, everything is inundated by walls of sand coming down today. I have a picture if anyone should care to see it and the gentleman who is head of the Lands, Mr. Walther who you said was here, Mr. Hemmer we sent you a picture of Nye Creek taken on the first of May in our comments to you. Full of sand, the water comes into one end and it can't go out the other and it will finally go out when the wall of water hits us when the runoff comes in the spring in one solid wave of silt, sand, and sqooshy stuff which gets into everything. You have heard of silicosis, miner's loam, and so on. We all have it because we are living in that atmosphere. When the American Chrome Company left, as I said, they didn't do one darn thing to clean it up. Now what did happen. And I'm telling you the truth ladies and gentlemen, I am giving it to you straight, I invite you, I've invited many others, I've invited state people, federal people to come and look at this. They haven't come. The Forest Service has because it is there problem too. Two people did come. One was the vice president of Anaconda Corporation who, three years later, after they acquired it from American

Thank you for your comments. Please refer to the responses to your written comments, letter #8.

Chrome and their environmentalist, that was Mr. Anderson and their environmentalist Frank Laird were the only two people who came. They spent hundreds of thousands of dollars trying to clean it up. We probably have it reduced to 10% of the original problem, but it is still there. I have pictures also where I am engaged almost full time in the spring during a period of about 2 to 3 weeks. I employ people with bulldozers to come and doze the sands out of the settling ponds. The settling ponds which the Anaconda folks and myself created to trap these tailings which still come down and which still get into our water systems, kill our fish, which still blows until you can't see the mountain in the winter time and which still choke up Nye Creek and the river. The bottom of the river fish can't spawn there because it is filled with sand and as the avalanche of sand comes down when the high water comes. It sounds grim. It is worse than that and I invite you to come and visit us. You get a cup of coffee at the worst and I'll take you up personally and show it to you. It is there and it is only 5 to 10% of what it used to be. That is what happens when an irresponsible mining company walked away from it and I do take my hat off to the Anaconda people, Mr. Anderson and Mr. Laird, because they were responsible individuals and they spent seven years and an awful lot of their company's money in trying to, they didn't clean it up but they did their best and it did stabilize it. Now that is what has happened in the past. What is going to happen now I can't answer as Mr. Francis did to what is going to happen to others. I can only sense, and I will not comment on the pros and cons because it has not purpose here, I will only comment on environment as it affects me, not as it affects anybody else. I guess that's selfish, but it is going to put me out of business. I have a first-class place and this mining operation, they don't mean to, they don't mean me any harm, but that is beside the point, they are going to put me out of business. The noise level, which is talked about in the impact statement. I will just give you a general idea. They had an air compressor for the test drilling operation for several years there. Most people going by wouldn't even hear it. Our guests said if we had known, many of them, we were coming to listen to this all night long we wouldn't have come because we did not come here to be next door to a mine. Multiply that by probably 100 and I'm not condemning the mining operation. I am not speaking critically of it, please believe me, I am merely telling you what is going to happen to us and I am tired of things happening to me, because I was there first. I was not there first with American Chrome, they were there first, but I was here before this mining operation and I am going to tell you what is going to happen to me and why. The noise level with 100-fold greater than that one turbine. There will be commercial vehicles roaring day and night at that minesite and I am a quarter of a mile away. Right across the river from it. Half a mile at the farthest, quarter mile and I adjoin in places. Their settling pond adjoins me. The commercial vehicles, the noise of the machinery and all of the other noise pollution will do it to us right there. But if that didn't there are other factors that would. The traffic, the closing off of the Forest Service road which is one of the most beautiful trail rides you can ever imagine. It is an all-day, it's a champagne ride. Our guests love it because you go up the side of that mountain, it's a Forest Service road and you get up on top of Horseman Flats, you can go over to Initial Creek and it is one of the most gorgeous rides you can ever imagine. My guest love it. It will be gone. It will be closed off. I can't use it any more in accordance with this environmental statement. The road which is another we take to Woodbine and to Sioux Charlie Lake and we ride up part of it on the Forest Service road. I wouldn't dare do it because of the traffic that is going to be involved and you can't ride horses with guests up there. Noise of the operation, the vehicles, the chaos created by it, the dust and the commercial atmosphere, the closing off of the Forest Service roads, the closing off of the road to Woodbine will simply put us out of business. And one might say, so what concern is this of mine? I think it should be a concern of everybody. You are not aware of how it affects your neighbors. And the draft impact statement made no mention, I was disappointed in this, of how that operation would affect other commercial, we employ 25 people during the season. We bring in a lot of money to the community, an awful lot of it in these guests who come in. We are filled here during the season all of the time and these are people that have a lot of money. But at the same time, what, backing off a bit. Why was this not addressed? I can only make a retorical question. Why was not the questions addressed in the environmental impact? How will others who are in business be impacted? Is it right to put a slaughter house up next to a first-class restaurant that already exists? I am going to make two final comments before I just go on to the third one and that will take about 30 seconds, Mr. Walther.

The first one, what can I do about what happened before? The answer--I've done all I could. I'm still doing it. I'm still fighting it. I have pictures that show where I am up to my navel in sand all of the time fighting it. What can I do about this operation? Because, let me assure you that if hard times should come, and it has already come to Anaconda, it has already come to Johns Manville and heaven forbid it coming to Chevron because I think that is one of the top ten corporations in America. It probably won't, but it might. But what happens if there is a downturn in automobiles and platinum? They are not going to operate that mine if it is operating at a loss. They will have to close it. Just like all other operations close and will they walk away? And can you guarantee that there will not be the same situation occur as occurred when American Chrome walked away from theirs and anyone in doubt of that come up and visit me. There it is. They walked away from it and left that obscenity ruin that end of the valley. That is the first question.

The second question is, is it right to put somebody out of business? And how do I know they will put me out of business? I'll know by the end of this next season because I am going to have a sampling of every guest I have and I know the answer already, but it is going to put me out of business and it is not right and I say this, it is not a threat, it is a simple statement of fact, I was here first and any mining company that comes in and drives me out of business is going to have to bear the responsibility for it. It is a flat direct statement. Not a threat, nothing else. But a statement. This is my library. I don't want to give it up and if I have to give it up the person responsible is going to have to face up to it.

Now, the third thing I wanted to talk about. What is in the future? We've seen the passage of the carrier pigeons, the buffalo, the God knows what things of beauty of nature out of this magnificent Stillwater Valley up here. The life of which you seldom see. There is nothing like it. The wildlife, according to your impact statement, will be severely impacted. In other words, they will go away. The big horn sheep, fishing will be almost nill. That and multiply it by 100-fold as to the, again, another, and I agree with Mr. Francis, I surely hope that if they do come, that they put their tailing pond away from me so I don't have to look across the river at it because that is exactly what would happen. But to tear up, to ravage, and that is what a mining operation does, whether it is in Butte or whether it is at Provo, Utah, or anywhere else it ravages the community and the country. Sometime we've got to put a stop to it because we only have so much of it left. Mr. Walther and ladies and gentlemen, I thank you for your time. I hope that I was not overly melodramatic. I spoke the truth. Anyone who wants to come up and see what we have at least you get a cup of coffee out of it.

TESTIMONY #3

GERALD EVANS:

I just had a few things that I wanted to address that were in the impact statement. I think it was a very well done statement. I agree that alternative 4 looks good. Regarding big horn sheep--they are in-bred, but I don't think that the mine themselves will affect them that much. If you go up there right now, you can walk within 50 feet of them or closer. If someone started shooting at them, yes, it would hurt them. Possibly, some new kids and ewes come in. They tried bucks, as I understand, they'd take off. The fishing--it was five or six year ago--the statement says that possibly regulation might have to be changed. Five or six years ago they went to an all year-round season. I think without the mine they ought to go back to a regular season. We're depleteing them during the Rainbow and the Brown spawning season. I fish a lot and I get a lot of spawners and I believe that the fishing is no worse now because of population if we went back to a season such as the Rosebud and the Slaughter Creek sale. Mr. Mouat...

Thank you for your comment.

TESTIMONY #4

RED DUTCHER:

Well, I'm glad Jerry cleaned that up for me because I was miquoted in the paper . . . and I worked up there for Redpath and stopped ore trucks, and honked at them, even got off of them and waived sheep out of the way so that we could get to the dump with our load. We didn't scare them off, we enjoyed watching them. As a matter of fact, none of the miners that were employed by Redpath the time I was there would even hunt the area for deer or elk. The environmental impact on fishing--I have a bar at Fishtail now. I see the summer traffic. You have some campgrounds up here that are filled every weekend by more, probably three times as many people than the mine will ever employ as long as it is here. Miners aren't really a whole lot into fishing. There is a few of them that are. I've been here over 20 years and I like doing it, but I agree with Jerry, if they want to worry about the Stillwater River they should cut it back from year around to regular seasons like the rest of the streams. Another thing I'd like to say on the impact--the miners that are going to stay here should this mine close down. In general, miners are transient people. We go where work is. There has been three different projects, or phases of development, on this mine since 1979. I'm one of the only people that still lives here of all the miners that have been through here. It is the same way in any production area I've worked all over the world. When the mine closes down, the miners leave. It is the only profession they know and they have to go where there is mining to make money. As far as your welfare program and the big impact on that--I don't see where we'd have any problems with that at all. As far as criminal aspect which has been insinuated in several articles--the mine has not operated for about a year now and there has been more criminal activity in this county than there was four years before it. So I don't know why that is. It seems to me though that if you have miners up here making a good wage, they are not robbing bars and gas stations, they are not poaching deer when they can buy lobster. Thank you.

Thank you for your comment.

TESTIMONY #5

GROVER RICKMAN:

Mr. Chairman, I thought I was going to be first and all I had to say was welcome to everyone for coming. Most of the comments that I had have already been given. Stillwater County and the Stillwater River are not virgins as far as mining goes. The old Nye City Mine was in operation over 100 years ago. I don't think anyone in the room can find their site where they were. We all know the Mouat minesite, we can see that. We can see the Benbow minesite. Those were activated during a time of emergency and, as you can see at Benbow, that has never been cleaned up, Uncle Sam did that. Since the mining activity in the county, the environmentalists have caused several laws to have been passed requiring impacts, ways of solving problems associated with mining. A national Environment Policy Act of 1969 and the Montana Environmental Policy Act of 1971 are those that are most publicized. However, Stillwater County and the other affected units of our local governments have been involved in hard rock mining economic impact plan for the past year and a half and in cooperation with Stillwater Mining Company, the public facility and service needs of projected mine-related population have been well planned. I am speaking for the county commissioners and others that have taken part in presenting items to be included. We are all confident that any potential problems from the mine can be solved due to the manner in which the program was put together. Stillwater County has a history of mining and I think the county in general is looking forward to the mineral development proposed by the Stillwater Mining Company and our written comments are going to be presented by the June deadline. Thank you.

Thank you for your comment.